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ABSTRACT

This proceedings includes 62 papers presented at the 12th annual International Academy for Information Management (IAIM) conference. Topics of papers include: electronic undergraduate courses; software for teaching change management; cooperative projects; experiential learning; World Wide Web applications; internationalization of the information systems curriculum; teaching information systems abroad; distance education; student creativity and active learning; master's programs in information systems; training, technical support and control; a contrary view on Cyberspace and technology; cognitive style, student performance and database design; theory versus reality in teaching database and systems development; GUI (graphical user interface) and object oriented programming in COBOL; user interface development; peer learning; order and concurrency effects of undergraduate programming courses on learning; student motivation; information systems job requirements; accreditation efforts; instructional innovation; paperless classrooms; using theory of constraints to teach; program evaluation; multimedia design; curriculum change; internships; academic computing laboratories; neural network publications; behavioral analysis; a conceptual framework for research; "Netiquette"; cross-disciplinary courses; instructional design; team teaching; new roles of information systems executives; foreign investments opportunities; end user training; and characteristics of student interaction. Also included are the IAIM mission statement, description of the paper selection process, a list of reviewers, 1996-1997 IAIM officers and directors, and an author index/directory. (AEF)

PROCEEDINGS

12th Annual Conference

International Academy for Information Management

IAIM

Atlanta, Georgia

December 12-14, 1997

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12th Annual Conference

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Editor
Camille Rogers

Georgia Southern University

International Academy for Information Management

Atlanta, Georgia

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ACKNOWLEDGMENT

Many individuals not directly involved with the IAIM program have contributed to the continued success and growth of IAIM and the publication of these *Proceedings*. The greatest contribution to the *Proceedings* was made by Debbie Cooper and Carol Waller who did the bulk of the formatting for the articles that are found on the following pages. Georgia Southern University's College of Business Administration Dean Carl Gooding and Lloyd Dosier, director of Publications and Faculty Research Services, must be thanked for donating the technical and professional support provided by the Publications office staff.

IAIM's Research Committee chair, Betty Kleen, was responsible for the paper review process and the grouping of accepted papers into the sessions that appear on this year's program. Tom Case coordinated most of the technical activities needed to put on this year's conference. We are grateful to Camille Rogers for performing the registration process. The conference staff of the Atlanta Hilton and Towers should be thanked for their pleasant, professional, and cooperative working relationship with the IAIM Board and Program Committee.

International Academy for Information Management

Atlanta, Georgia

December 12-14, 1997

MISSION STATEMENT

The objective of the *International Academy for Information Management* is to provide a forum in which interdisciplinary researchers and educators in Information Systems can exchange ideas, techniques, and applications.

International Academy for Information Management

Atlanta, Georgia

December 12-14, 1997

PAPER SELECTION PROCESS

Each year, the process of selecting high quality papers/panels for inclusion in the IAIM annual conference is demanding. Each and every one of the individuals who assisted in the process is owed a debt of thanks. We are sincerely grateful for the time and effort that they devoted to ensure a strong and balanced program covering the major pedagogical issues and concerns of IS educators and trainers, as well as other professionals who incorporate information technology within their disciplines. The fruits of their labors are evident in the papers found on the following pages.

Copies of paper/panel abstracts were submitted to Research Committee Chairman Betty Kleen at Nichols State University. Copies of each abstract were sent to at least three of the reviewers listed on the following page for blind review. Each reviewer critiqued a minimum of three abstracts on the basis of the appropriateness of the topics and the contribution of the approach and results toward strengthening IS pedagogy. Acceptance recommendations were returned to Betty Kleen who was responsible for making the final acceptance decision. Authors of the accepted papers were notified of their acceptance and were sent guidelines for submitting final drafts of the articles to the *Proceedings* editor.

Papers considered "best" are announced at the IAIM Conference. Authors are then asked to revise and submit for review for acceptance to the *Journal of Education for MIS*. Selection of papers for the journal is competitive and rigourous with an acceptance rate of less than 10 percent.

The articles submitted by authors who completed their final drafts by the specified deadline appear in the following pages. The original abstracts submitted for review by authors who were not able to meet the *Proceedings* deadlines also appear in the following pages.

By reading the articles and abstracts that follow, the quality of the work performed by all of the individuals involved in the paper selection process is apparent. We are truly grateful to the members of the Research Committee, the reviewers, and the authors of the papers for contributing to the success of IAIM's 12TH Annual Conference.

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We thank the following reviewers who contributed their valuable time to the International Academy for Information Management:

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The effort of the Officers and Directors of IAIM for 1996-97 should also be acknowledged. The following individuals devoted considerable time, effort, and in some cases made personal financial contributions in order to attend Board meetings and to maintain and enhance IAIM as a professional organization. A considerable amount of program planning and program related decision-making was conducted at the Board meetings.

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AN ELECTRONIC COMMERCE COURSE FOR UNDERGRADUATE I.S. MAJORS: A REVIEW OF CURRENT EC COURSES AND A COURSE OUTLINE

James S. Dutt
Bloomsburg University

Although electronic commerce (EC) has been a reality for more than two decades, interest in EC has exploded within the past three years due to the increased business interest in and use of the Internet and the World Wide Web. While companies are increasingly looking for individuals with knowledge of and/or a background in EC, they are finding that most universities do not spend adequate time, particularly at the undergraduate level, on EC. This paper examines the degree to which Information Systems (IS) programs are teaching courses on electronic commerce, describes the types of EC courses being taught, and presents an outline for an upper division EC course designed for undergraduate IS majors.

INTRODUCTION

Within the past several years business interest and involvement in Electronic Commerce has exploded. This new interest in EC appears to be directly related to the commercialization of the Internet, and the development of the World Wide Web, and the increased focus on the re-engineering of basic business processes. While there are many different definitions of EC, it is agreed that EC extends beyond the boundaries of a single enterprise and relies largely upon computer to computer exchange of data (Clarke, 1997; Kalakota and Whinston 1996, Zwass 1996). EC automates the interchange of all information needed to conduct business, such as the placing and tracking of orders, the delivery of products and services, and the exchange of funds. It is a relatively new technology that relies on computing and communications services to transfer digital information between applications and is typically used to transfer information that has traditionally been transferred using paper, voice, or fax. EC has two primary benefits over the use of traditional systems: speed and accuracy. Both of these result in sizable cost savings, improved service, and improved efficiency of business and personal transactions (Bloch, Pigneur, and Segev 1996). Electronic Commerce (EC) is implemented through a combination of technologies that exchange data (like EDI, e-mail, the World Wide Web), access data (shared databases, electronic bulletin boards, the World Wide Web) and automatically capture data (bar coding, magnetic/optical character recognition).

While some debate the value of EC, and there is data which indicates that corporate America is not adopting EC as fast as projected (Hayashi 1996, Ho 1996), there is little doubt that the term EC has become a popular phrase. There are a variety of new publications, both professional and academic, devoted to Electronic Commerce. EDI World has recently been renamed EC World. Major IT firms are advertising their Electronic Commerce solutions; for example, see IBM's Web Site: http://www.ibm.com. Thus, while EC may have become the current IS buzzword, it has substance and promises to increase in importance.

From a technical standpoint, Electronic Commerce involves a variety of issues / topics including security, Internet based EC, privacy, communication protocols, value added networks, Intranet, electronic cash, html, Web Sites, CGI scripts, database access, Java, and EDI. Business are currently evaluating and implementing a variety of EC systems which often involve emerging technologies.

While interest in business involvement in electronic commerce is growing rapidly, many in business believe that IS programs are not equipping IS graduates, particularly undergraduates, with skills and experiences in EC. As J. Maglitta notes "... few graduates are trained in new technologies - such as telecommunications and relational databases - or even exposed to them. Even fewer are taught project management, communication, documentation and team skills. Fewer still learn about . . . new areas such as electronic commerce and business process re-engineering." (ComputerWorld: 2/19/96:82). In another recent article in the professional press, May (1997) notes that IS professionals must develop a new set of skills in order to provide leadership in developing new EC systems. May goes on to note that the evolution of net-based electronic commerce is creating new IS opportunities including: Systems Architect , Network Infrastructure Support , Web Site Developer, Webmaster, Technical Support/Help Desk, and Resident Artist/ Photographer/Post-Production Editor.

In discussions with representatives of businesses recruiting IS graduates from Bloomsburg University, IS specialists and Human Resource professionals indicate that they have found that IS graduates are generally technically well trained. The students they hire for entry level positions can program and have good analytic and design skills. However, recruiters report that their new hires often lack an understanding of business processes and how IT enables these processes. As a result, new hires rarely bring new ideas or approaches to business with them. The companies that recruit IS graduates are looking for employees who not only have technological skills, but also understand the realities of electronic commerce.

Just how accurate are the above criticisms? Are IS programs focusing on EC? Are courses being offered on electronic commerce? If so, who is the audience and what is the nature / content of these courses? Are IS programs equipping IS graduates with the skills and knowledge necessary to develop EC applications?

CURRENT STATUS OF ELECTRONIC COMMERCE COURSES

As noted above, while EC has been with us for some time, it has only recently become part of the business vocabulary. This also appears to be the case in the academic IS arena. The various IS model curricula which have been developed in the past twenty years do not deal with EC in any significant way. The latest model IS curriculum, IS'97, developed by a joint AITP, AIS, and ACM task force (Davis, et al. 1997) does not directly address EC. While the issues, technologies, etc., which are used in EC are covered in the new curriculum, IS'97 does not include a course whose focus is EC.

While the model curriculum may not include an EC course, a number of IS programs do offer courses in EC. To determine how frequently EC is being taught in IS programs, particularly at the undergraduate level, and the nature of these courses, a sample of 100 IS programs was randomly selected. Only programs which offered an undergraduate IS degree were included in the sample. The chairperson's office was contacted by phone. The chair, another faculty, or, in some cases, an administrative assistant was asked whether the department currently offered an electronic commerce course at the graduate and/or undergraduate level. If an EC course was offered, the respondent was asked to send a copy of the course syllabus. If a department did not currently course offer an EC course, they were asked if they were planning to add such a course to their curriculum.

Frequency of Electronic Commerce Courses

Detailed data were obtained from 75 of the departments contacted. The data is summarized below. Two-thirds of the departments who responded did not teach EC courses at either the graduate or undergraduate level and did not plan to add one. Many reported that they covered various aspects of EC in one or more existing courses, data communications and management information systems being the most common. Ten departments taught an EC course at the graduate level, while three offered EC courses at both the graduate and undergraduate level. Eight departments reported that they planned to add an EC course to their curricula in the next year or two. The majority of the courses in the planning stage will be offered at the graduate level. In addition, several departments reported that an electronic commerce course was being taught but by another department, most often the marketing department.

	Number of Programs	%
Do Not Offer An EC Course	51	68%
Offer an EC Course at the Undergraduate Level Only	0	0%
Offer EC Course at Graduate Level Only	10	13%
Offer EC Course at both Graduate & Undergraduate Levels	3	4%
Plan to Add EC Course within Two Years	8	11%
EC Course Offered by Another Department	3	4%

While not a random sample, additional data on electronic commerce courses is available via the ISWorld Web site. A collection of pages is devoted to EC (URL: http://www.isworld.org/isworld/ecourse/isw34111.html). This site gives links to 22 different electronic commerce course syllabi (See Appendix I for a the course title and program). Of these, only 4 (18%) are for undergraduate courses, while the other 18 are for graduate courses, primarily offered as electives in MBA programs. While most of the courses represented here are taught by IS faculty, at least two courses are offered by marketing departments. Also, it should be noted that it appears that several of the courses were special seminars which were taught once.

The Nature (Content) of Electronic Commerce Courses

Examination of the Electronic Commerce course syllabi, both those available on line and those sent by schools that currently teach Electronic Commerce courses, indicates that there is a wide variation in the content and design of electronic commerce courses. Courses differ in terms of their target population, prerequisites, course focus, assignments and projects.

Target Population: Courses differ with respect to whom the course is being marketed. Most of the current Electronic Commerce courses are offered as an IS elective for as part of an M.B.A. Program. In a few cases, due to the prerequisites required, enrollment is essentially limited to IS majors.

Prerequisites: Since the target population of the most current Electronic Commerce courses tends to be general business students, most frequently MBA students, these courses have minimal prerequisites: an MIS course or simply the basic computer literacy course. In some cases, the only prerequisite appears to be the basic ability to use a computer and familiarity with e-mail.

Course Focus: Electronic Commerce courses also differ considerably in their content. While several have a technical focus and place considerable emphasis on Electronic Data Interchange, the majority of the courses focus on the Internet, the WWW, and the "Information Super Highway". This Internet emphasis is also evident in the titles of the courses whose syllabi can be accessed via the collection of EC syllabi can be found at the IS World NET Electronic Commerce Course page. The Internet / Web emphasis is evident from the titles of many of these courses:

Commerce on the Information Highway

Doing Business on the Internet

Electronic Commerce: Business Uses of the Internet

Electronic Commerce: Internet Technologies for Competitive Advantage

Electronic Commerce on the Internet

Internet for Business

Marketing and the Internet

Riding the Information Super Highway

The Information Superhighway

Use of the Internet for Business and Commerce

Assignments and Projects: Analysis of the syllabi of EC courses indicates that all have a significant hands-on component. Students are required to complete a variety of homework assignments and one or more larger projects. Examination of these assignments provides additional information on the focus and nature of the courses.

Homework Assignments: Assignments are completed by individual students. They vary widely and include:

- Create a personal home page with resume.
- Purchase an actual good or service over the Internet.
- Analyze a business Web site.
- Analyze an electronic commerce case.
- Analyze Internet utilization of a specific industry.
- Create a Web form with associated scripts.
- Conduct individual research assignments.

Projects: The nature of these projects obviously depends upon the target population. Nearly all projects were to be completed by student teams. Projects include:

- Construction of a Web page and/or Web site for a business or business unit.
- Development of an Internet Business Plan.
- Detailed analysis of a business Web presence.

Discussion: Although businesses have been engaged in forms of Electronic Commerce for nearly 30 years, interest in the subject has recently exploded due to the Web. Today businesses are utilizing the Internet and the Web to reach customers and to conduct EDI. While IS programs occasionally included a course on EDI, electronic commerce, if covered specifically, was a component of the Management Information Systems course or the data communications course. Recently, as business use of the Internet has increased and Electronic Commerce has become something of a buzzword, the number of IS departments offering courses focused on electronic commerce is increasing. Unlike many areas of IS (e.g., programming, systems analysis and design, data communications) where courses are often quite similar, EC courses vary considerably. This is not surprising given the rapidly evolving nature of EC, the diversity of audiences being targeted, and the lack of a Electronic Commerce course in past and current Model IS curricula.

There are two important findings from the analysis of the data collected via the phone survey along with examination of on-line syllabi. First, less than 30% of IS programs offer an electronic commerce course. The majority of the courses being offered are offered at the graduate level. Currently few IS programs offer an EC courses at the undergraduate level. Secondly, the majority of the EC courses currently taught focus primarily on the Internet and the Web based EC and tend to be descriptive in nature. Assignments and projects tend to have a distinct Web orientation: html, Web Page development, etc.

IS departments generally have two educational roles. The first is to educate IS majors, the second to provide IS courses for students in other disciplines. IS departments frequently teach an introductory computer course ("computer literacy"), and management information systems courses at both the undergraduate and graduate levels. Some programs offer additional elective courses for non-majors, particularly as electives in an M.B.A. Program.

The majority of EC courses currently being taught appear to be service courses, that is, they are designed for the general business student or for students minoring in IS. Most are offered as electives in M.B.A. Programs. Given the increasing importance of EC and its potential impacts on all aspects of business, it is important that we continue to design and teach EC courses for the non-IS major. However, it is my contention that such courses do not provide the detailed knowledge and experience in developing EC applications that many employers are looking for in prospective IS employees. Most of the current courses focus on the business implications of EC, not on the actual development of EC applications at the system level. An EC course designed specifically for IS majors is needed.

AN ELECTRONIC COMMERCE COURSE FOR IS MAJORS

Electronic Commerce is increasing in importance and has the potential to significantly change the way in which companies conduct business. There is a demand for IS professionals who have knowledge and skills in the development of EC applications.

I suggest that an EC designed for upper level IS majors would make an excellent senior experience for IS students, in a way the IS equivalent of the business policies course which is part of the typical business core curriculum. EC involves understanding business processes and applying the technical knowledge and skills developed in the programming, systems analysis and design, database, and data communications courses to enhance those processes.

Information Systems is an applied rather than a theoretical discipline. Much of the learning is experiential in nature. Students learn to program by writing programs; they learn to analyze business systems by going into a business and asking questions; they learn Web page development by developing Web pages. I believe it is important that an upper level EC course has an appropriate experiential component. Students would benefit by being involved in the actual conduct of some form of electronic commerce.

To this end an outline of an elective undergraduate EC course designed for senior IS majors has been developed. A Course Syllabus is included in Appendix II. The course as currently being taught is designed for upper level IS majors and is a senior capstone experience requiring the participants to integrate the skills that they have developed in the past three years. The course has two primary goals. The first is to provide IS majors with an opportunity to learn about Electronic Commerce, the issues involved, and how it is transforming the way in which businesses interact with one another. The second goal is to provide students with the opportunity of developing EC applications. Thus, the course has a significant hands-on component which makes it quite different from the EC course offered as an elective for MBA students.

To be eligible for the class, students must have the completed the following courses: systems analysis and design, data communications, and database management. The database course can be taken simultaneously. Students enrolled in the course have at least three years of experience working in a UNIX environment, can program in both C and COBOL, and have expertise in Web page development. Many have also taken a course in Java.

The course as currently taught requires hardware and software resources. Currently we are using an IBM RISC 6000 server, Model F40, as the primary platform for the course. The server is run and maintained by the CIS students and used only in upper level IS courses. Both Oracle and DB2, Netscape's Web server software are installed on the server students

The course includes components on EDI, the Internet and the WWW, Intranets, data security, consumer oriented EC, intra- and inter-organizational EC, and organizational and societal impacts of EC.

Students are required to complete a variety of individual assignments including reviewing commercial EC software, locating additional EC papers and EC related Web sites of the Web, reviewing Web based EC applications. Teams of students have also been formed and been assigned specific projects. For example, to develop a firewall for the server, to develop a Web interface to a DB2 application. In the next iteration of the course, we would like to have teams of students at several different Universities develop virtual businesses and conduct business with each other using EDI. We are also exploring the possibility having students in this course develop prototypes for a new university scheduling system.

The text for the course is Frontiers of Electronic Commerce, by Ravi Kalakota and Andrew Whinston; Addison Wesley, 1996. The material in the text is supplemented by a variety of on-line material. There is an extensive amount of information and resources on EC available on the Web.

Student reaction to the course has been extremely positive. Members of the College of Business Advisor Board and visiting IS professionals have been very complimentary and supportive. The course is currently being taught as an experimental course, but we plan to submit it to the university curriculum committee as a new IS course. We believe that the course will be an important addition to our curriculum and is an appropriate senior level IS elective.

SUMMARY AND CONCLUSIONS

Interest of businesses in EC is increasing rapidly. There is a feeling among some IS professionals that IS programs do not prepare graduates with skills in Electronic Commerce. A survey of IS programs indicate that few programs offer EC courses expressly designed for IS majors. The large majority of EC courses are offered as electives in M.B.A. programs. These course focus on the business impact of EC not on the development of EC applications.

IS is a professional discipline, and while IS programs vary considerably, a central component to their missions is to prepare undergraduate majors for challenging, rewarding careers in Information Systems. Providing students with the opportunity to develop EC skills will increase their career opportunities.

Curriculum development is a complex task, particularly in a rapidly evolving field such as information systems. There is always the danger that a course developed in reaction to an industry need will become obsolete in several years as technology changes. How responsive should IS programs be to industry needs? For example, an examination of position openings found in major metropolitan area newspapers (New York, Boston, Washington, Philadelphia, etc.) suggests that there is a shortage of IS professionals with knowledge of and experience with S.A.P. Should IS programs develop courses which focus on S.A.P. And enable students to learn how to work with S.A.P. Applications. Such training would certainly help meet this need? It is my belief that most IS educators would argue against developing a course focused on S.A.P., particularly at the undergraduate level.

Is EC all that different? Is this not simply a response to an industry need? Unlike S.A.P. which after all is a commercial organization which develops corporate level software applications, Electronic Commerce refers to the automation of business processes which connect businesses with one another. The emphasis is on commerce and how IT can be used to improve existing processes or develop new ones.

The prototype EC course for IS students described above includes a significant hands-on component giving students the opportunity to develop actual EC system. While many of the topics may be covered in other IS courses, it is argued that an integrated approach which focuses on EC and provides students with the opportunity to conduct EC is a more appropriate way of teaching an increasingly important area of information systems.

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APPENDIX I

ELECTRONIC COMMERCE
A COURSE FOR IS MAJORS

Description:

This course provides a detailed examination of electronic commerce. Students study various forms of electronic commerce: EDI, Internet and Web applications. Emphasis is on the actual development and implementation of electronic commerce applications.

Goals/Objectives:

1. To develop a detailed understanding of EC and its implementation
2. To become familiar with how EC is changing standard business processes..
3. To develop a working knowledge of Electronic Data Interchange and EDI software.
4. To become knowledgable on securing a Web site.
5. To develop a skill in writing CGI scripts.
6. To examine various EC issues: marketing on the Internet, legal ramifications of electronic transactions, etc.

Audience:

Senior IS and CS students or the permission of the instructor.

Prerequisites:

Data Communication, Programming (C++ or Java), Data Base Management, Operating Systems, html and Internet Knowledge

Assignments:

Students will be required to gather data and submit reports on a specific commercial electronic commerce software product. Students will interface a html form with a database using a cgi script.

Course Project:

An important element of the course is an actual EC experience. Students form a virtual business and conduct electronic commerce with other virtual businesses at other universities.

Topical Outline:

Electronic Commerce
Overview
History and Evolution
Applications and Examples

Telecommunication Issues
Network Infrastructure
Value Added Networks

The Internet and the WWW
Evolution of Internet
Impact of Web
Internet commercialization
Internet Protocol Suite

Multicast IP
IP Future
Intranets
CGI Scripts

Secure Electronic Commerce
Client-Server Network Security
Firewalls
Data Encryption
Government Regulations

Electronic Data Interchange
Definition and evolution
Standards
Legal Issues
Commercial EDI applications

Electronic Payment Systems
Electronic Funds Transfer
Types of Payment Systems
Designing Electronic Payment Systems

Types of Electronic Commerce
Consumer-oriented EC
Intra-organizational EC
Inter-organizational EC

Electronic Documents
Digital Libraries

Impacts of EC
Organizational
Societal

Text:

Kalakota, R.and A. Whinston. Frontiers of Electronic Commerce. Addison Wesley, 1996.

Additonal course materials are avaliable on-line.

APPENDIX II

ELECTRONIC COMMERCE COURSES ACCESSIBLE VIA THE WEB SOURCE: ISWORLD NET

International Electronic Commerce - American University, Prof. Erran Carmel, Kogod College of Business Administration, Spring 1997. Graduate Course, MBA elective

Electronic Commerce - University of Louisville, Prof. Brian L. Dos Santos, College of Business & Public Administration, Spring 1997. Graduate Course

Doing Business on the Internet - Harvard University, Lisa R. Klein, Harvard Extension School, Spring 1997. Grad course

Marketing and the Internet - University of Delaware, Alex L. Brown, College of Business & Economics, Spring 1997. Marketing course

Electronic Commerce: Business for the 21st Century - New York University, Prof. Ajit Kambil, The Leonard N. Stern School of Business, Spring 1997. Graduate Course

The Information Superhighway - Boston University, C. Suzanne Iacono, School of Management, Spring 1997. Graduate course

Electronic Commerce - DePaul University, Chicago, Illinois, Dr. Sasa Dekleva, Kellstadt Graduate School of Business, Fall 1996. Graduate course

Computers and Modern Organizations - University of California at Berkeley, Berkeley, California, Dr. Malu Roldan, Haas School of Business, Fall 1996.

Internet for Business - David N. Myers College, Cleveland, Ohio, D. Trivison and R. Brhel, Fall 1996. Undergraduate course

Use of the Internet for Business and Commerce - Nanyang Technological University, Singapore, Dr. Gabriel Goren & Dr. Jon D. Kendall, Nanyang Business School, Summer/Fall 1996.

Using IT in a global economy - BI Stiftelsen Norwegian School of Management, Prof. Espen Andersen, 1996. Graduate course

Organisational Implications of Information Systems: Electronic Commerce - University College Dublin, Professor Blake Ives, Michael Smurfit Graduate School of Business, Spring 1996.

Commerce on the Information Highway -University of Pittsburgh, Professor Dennis Galletta, Katz Graduate School of Business, Summer 1995.

Managing Electronic Commerce - University of Rochester, Ravi Kalakota, MBA CIS course, Winter 1996.

Electronic Commerce on the Internet - University of Michigan, George Widmeyer, seven week MBA course, Fall 1995 and Spring 1996.

Electronic Commerce: Business Uses of the Internet - University of Illinois at Springfield, Rassule Hadidi, Fall 1995. This course is designed for the School of Business and Management graduate students.

Information Technology in Marketing - Columbia Business School, Rajeev Kohli, 1995.

Managing in the Marketspace - Harvard Business School, John Sviokla, 20 session graduate MBA course, Spring 1995.

Marketing and the Internet - Fuqua School of Business, Duke University, John M. McCann and John Gallagher, an elective course in the MBA program, Spring 1995.

Electronic Commerce: Internet Technologies for Competitive Advantage - Bowling Green State University, Simha Magal, Fall 1996. Senior level undergraduate MIS Class.

Riding the Information Super Highway - California State University at San Marcos, David Jankowski, Spring 1996. Undergraduate Course for all majors. Computer Literacy only prerequisite. Study of the Information Superhighway with an emphasis on hands-on usage of the Internet, and the personal, business, technical, and social implications of the Superhighway.

Electronic Commerce - Southern Methodist University, Blake Ives, Spring 1995. Experimental Undergraduate Honor's course. Internet / WWW focus

TOOLS FOR TEACHING CHANGE MANAGEMENT: THE MATRIX OF CHANGE™ AND SUPPORTING SOFTWARE

Erik Brynjolfsson
Stanford University and MIT

Marshall van Alstyne
University of Michigan and MIT

Abraham Bernstein
MIT

Amy Austin Renshaw
MIT

One of the key advantages of information technology is its ability to support new organizational forms. The task of shifting between old and new forms, however, can be a difficult, time consuming, and haphazard process (Davenport, 1993, Davenport and Stoddard, 1994; Hammer, 1990). Interactions among various work practices can lead to numerous unanticipated side effects as mangers alter individual practices without considering whole systems of work. In particular, the importance of complementarities among different practices has been formalized mathematically in the economic literature (Milgrom and Roberts, 1990). However, practicing managers and students have had difficult in applying these insights.

This talk will present recent developments in providing support tools for change management and explain how they have been effectively used for teaching students about IT-enabled change management in the core IT classes at MIT and Stanford. It will also demonstrate new software for use in both the teaching and practice of business process reengineering. The software has been developed using the Visual Basic programming language and executable versions will be available for delivery over the Worldwide Web for classroom use (see http://ccs.mit.edu/ MoC).

The core of the new teaching sequence is a new tool, the Matrix of Change, which helps to characterize such change management features as the feasibility of proposed changes, the preferred speed of execution, and the best sequence of changes. It works by identifying complementary and interfering work practices. Complementary practices reinforce one another. Doing more of one complement increases returns to another. Narrow job functions, for example, increase a firm's ability to offer piece rate pay so these practices are complementary. In contrast, interfering practices work at cross-purposes. A flatter managerial hierarchy, for example, shifts more strategic decisions to workers, decreasing a firm's ability to offer piece rate pay.

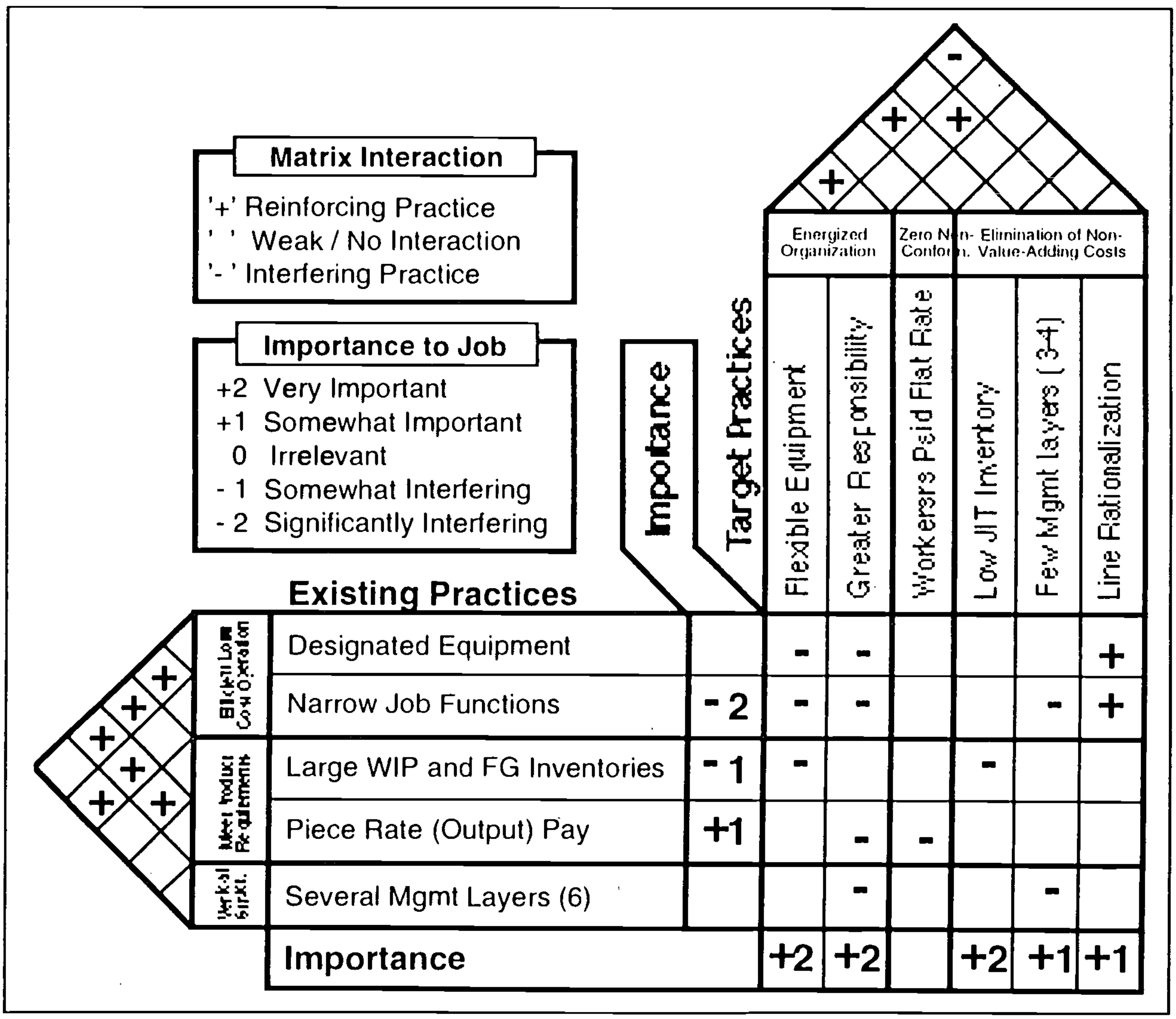
The experience of a large consumer products company provides an instructive example. Top management sought to use IT to drive a revolution in its manufacturing processes and they understood well that simply introducing IT was not enough to get the results they required. Accordingly, they specified a detailed plan for changed business practices in several areas including supplier relations, product variety, inventory policy, job responsibilities, management systems and incentives. After an investment of millions of dollars in highly flexible, computerized equipment, the firm was surprised to find that its productivity actually fell while it made no real gains in flexibility or responsiveness.

What went wrong? Close examination of the way workers were actually using the equipment revealed that they had only made surface level changes in their factories business processes. Many of the employees had several decades of deeply rooted experience with the old technology and systems and they found it all too easy to slip into their old routines.

For instance, with the old equipment, productivity depended critically on minimizing time-consuming change-overs from one product line to another and large work-in-process inventories were routinely built up to minimize stock-outs. With the new equipment, however, change-overs could be done in a matter of minutes and the management plan called for squeezing out inventories. Nonetheless, a lot of well-meaning factory workers continued to avoid change-overs since they "knew", or thought they knew, that always keeping the production line humming was the key to higher productivity. Ironically, with a little tinkering, they found that the new equipment was so flexible that it could be used just like the old machines! This may have made it easy to avoid changing their tried and true work habits, but the net result was that none

FIGURE 1

A MATRIX OF CHANGE ANALYSIS



of the anticipated improvements in flexibility, responsiveness or inventories were realized.

The basic problem with many business process redesign efforts is that the various components of the new system interact with each other. As a result, they often cannot be implemented in isolation. The accompanying diagram (figure 1) illustrates a few of the interactions at the consumer products company described above. In the figure, a representative set of existing practices for a more traditional hierarchy is shown juxtaposed against a representative set of target practices for a more modern manufacturing plant. The results are summaries of data administered as a survey to a group consisting of managers, engineers, and plant workers.

Plus signs indicate complementary practices and minus signs indicate interfering practices. In this example, under existing practices, designated equipment complements narrow job functions hence the "+" sign where these two practices overlap at the left of the diagram. However, it interferes with the target practice of providing workers with greater responsibility, as indicated by the "-" signs in the central matrix. A set of importance ratings also helps to indicate the relative value contributed by various practices as seen by respondents to the survey.

While this simple set of interactions is relatively easy to see, most IT-enabled process redesign projects involve a far larger number of interacting practices. For instance, really changing inventory policy requires more than a decree from above. It requires new incentives (the old piece rate system encouraged building up inventories) and new training. In fact, at the consumer product company, about two dozen distinct practices were involved in both the old work system and the new work system. IT directly changed only one of them, but indirectly, it required a much more complex collection of supporting changes.

This story had a happy ending. By increasing the level of communication among all the affected parties, the importance of aligning business practice with the new technology was better understood. Within two years, performance increased significantly at the firms' factories. The team implementing the changes found that many of the complicated interactions among practices could be visualized with the aid of an expanded version of the diagram above and some related tools. A more detailed description of this case and the change management tools that were used there was published earlier this year (Brynjolfsson, Renshaw and Van Alstyne, 1997).

The matrix is useful for answering several types of change management questions, including stability, pace, sequence, and transition difficulty. It suggests, for example, that the set of target practices is less stable than the set of existing practices since it contains interfering practices and many fewer complementary practices. Pace and sequence may be governed by the ability to identify blocks of complementary practices and remove them simultaneously. A block represents a cluster of thickly complementary practices. Given multiple blocks, the pace of change within a block should be rapid while the pace of change between blocks may be slow. The central matrix also shows how practices interfere so that target practices may be substituted for existing practices in a sequence that accumulates the least cost transitions. It would make little sense, for example, to introduce flexible equipment before the block of practices surrounding narrow job functions had been removed.

As a pedagogical tool, the Matrix of change has also been taught alongside alternative approaches to improve students comprehension of the change process in organizations. In particular, a more improvisational approach (Orlikowski and Hofman, 1997) emphasizes that change is incremental and that managers may need to revisit their preconceived plans as implementation proceeds and they encounter unanticipated obstacles. A learning approach (Leonard Barton, 1988) also emphasizes that the "know-how" and "know-why" of one group's change plans and experience may need to be disseminated among satellite groups to streamline the change process and allow groups to adapt to one another's modified behaviors. These alternatives nicely complement the Matrix of Change, which emphasizes the planning aspects of change management.

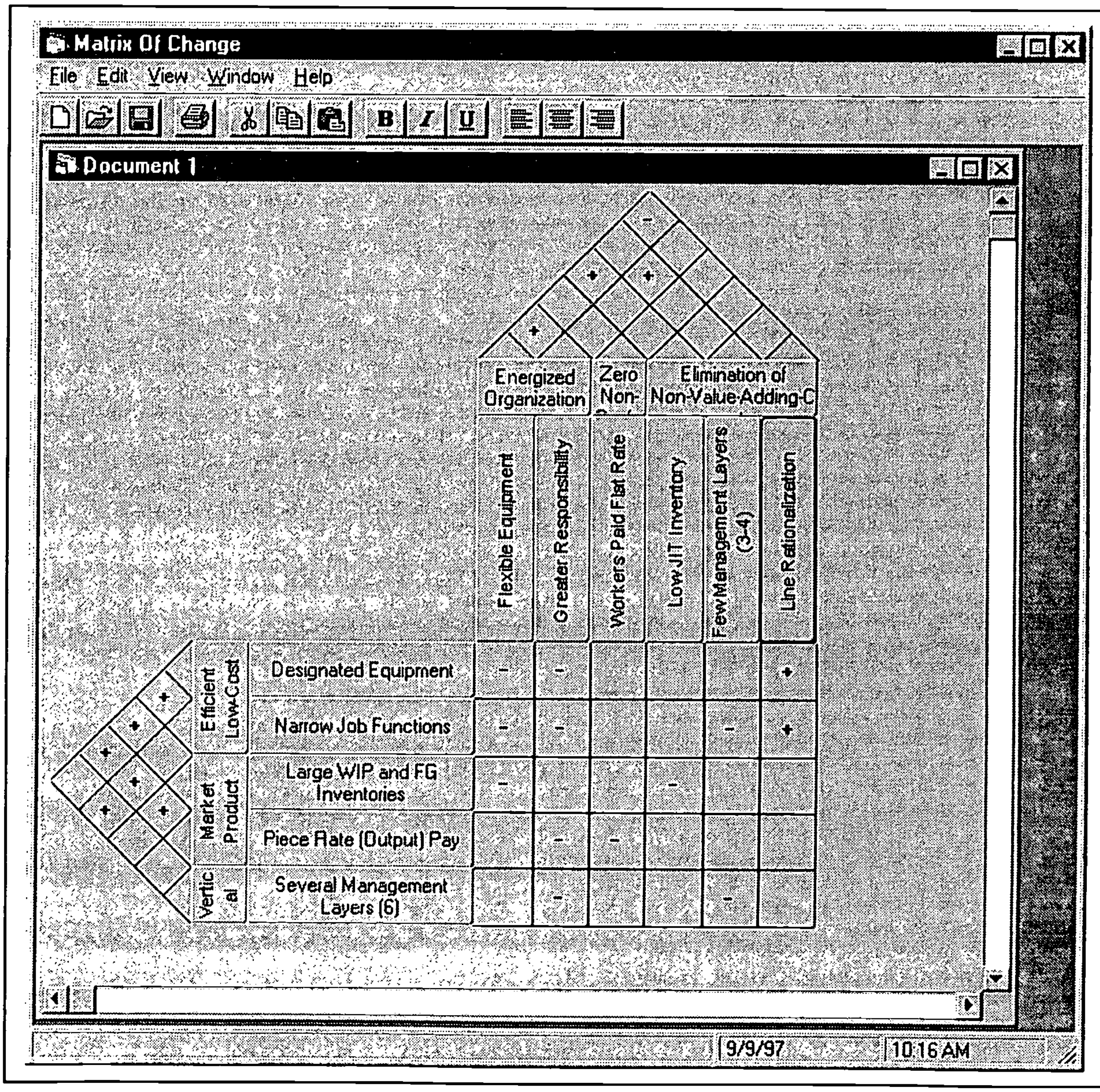
THE SUPPORTING SOFTWARE

We have a working prototype of the software to support construction of the Matrix of Change and its use in teaching.

We will demonstrate the software and make it available to interested participants at the conference. Several screen shots are presented in the appendix. We implemented the software using Visual Basic relying on the mostly object oriented features of version 5. The Matrix of Change software provides a standard MDI-interface and handles most operations by direct manipulation (like 'drag and drop', 'double-clicking' etc.). In terms of functionality the base release software offers support to draw the matrix and fill out its values as well as some sorting capabilities. These sorting capabilities allow users to sort the matrix according to the matrix-interactions. Furthermore reports of the matrix can be generated in Visio™. Online help will also be available.

FIGURE 2

A SCREEN SHOT FROM THE SOFTWARE IN USE



The software can be obtained from the Matrix of Change web site: http://ccs.mit.edu/MoC. It will be offered for download in form of a 'zipped' archive that will have all the executable files necessary to start the installation procedure. The software does not require any network connection. It was developed with the assumption that users will have to be able to use it while being at a field site as well as in their offices. In addition people may want to use the tool to examine proprietary data, they would not want to share over the Internet. We therefore chose the approach of developing a down-loadable application as opposed to a purely web-based tool. The software will only run on 32-Windows platforms such as Windows NT™ and Windows95™.

We are planning at least two major extensions to the current release: routing optimization and connections to a back-end database. The first extension will consider the possibility of optimizing the transition paths from the existing to target states to achieve a least cost or least disruptive path. The second extension will consider process specific knowledge captured in a large database of organizational practices [Malone et al. 1992]. Process specific knowledge might allow the software to automatically generate interference patterns in the matrix and enable the development of industry templates and allow for in depth studies in certain industries.

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APPENDIX

SCREEN SHOTS FROM THE MATRIX OF CHANGE SOFTWARE

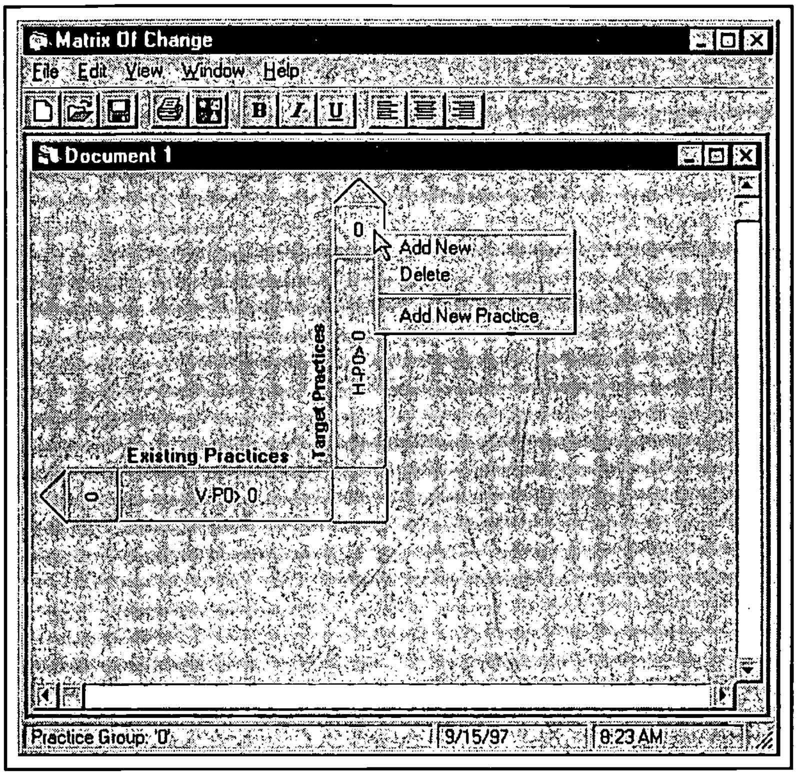

FIGURE A1

STARTING UP THE MATRIX OF CHANGE SOFTWARE

After Starting the Software an 'empty Matrix appears, in which every state has one default practice group with one practice. By clicking on the practice groups (respectively the practices) with the right mouse button new practice groups or practices can be added.

FIGURE A2

CHANGING THE NAME OF A PRACTICE (OR A PRACTICE GROUP)

Double clicking on a practice group or a practice pops up a dialog box which allows to rename the practice group (respectively the practice).

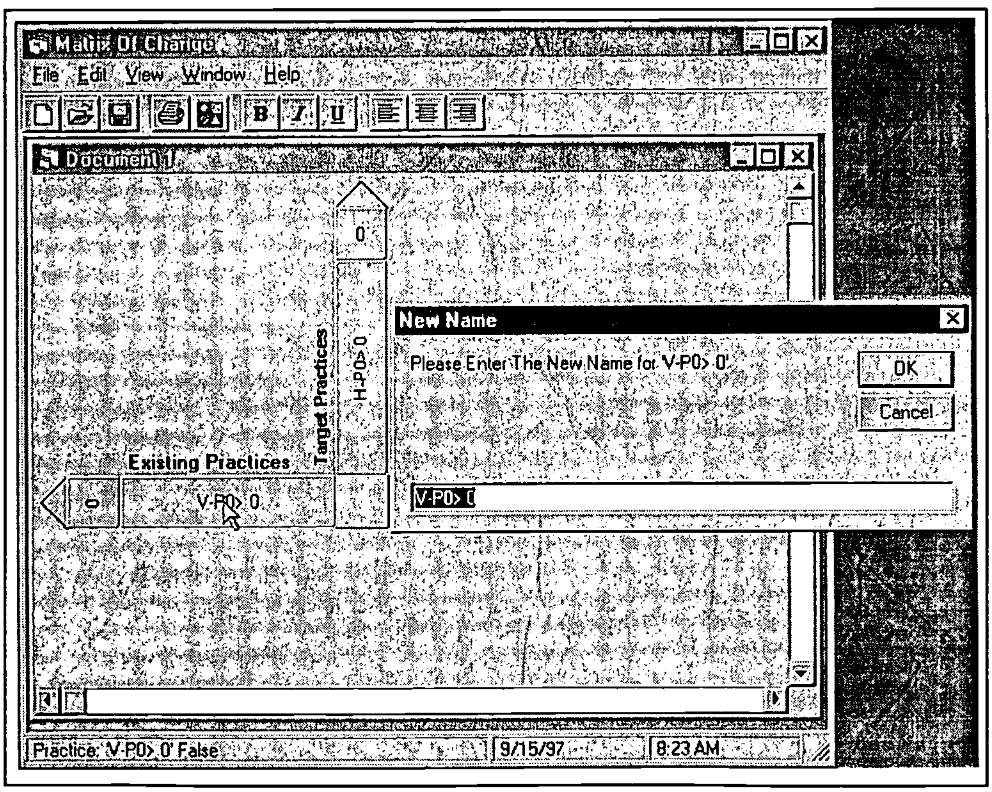

FIGURE A3

THE VIEW MENU

The 'View-menu controls the display of the matrix and the application. E.g. the importance rating or the legend can be hidden (as in this screen-dump).

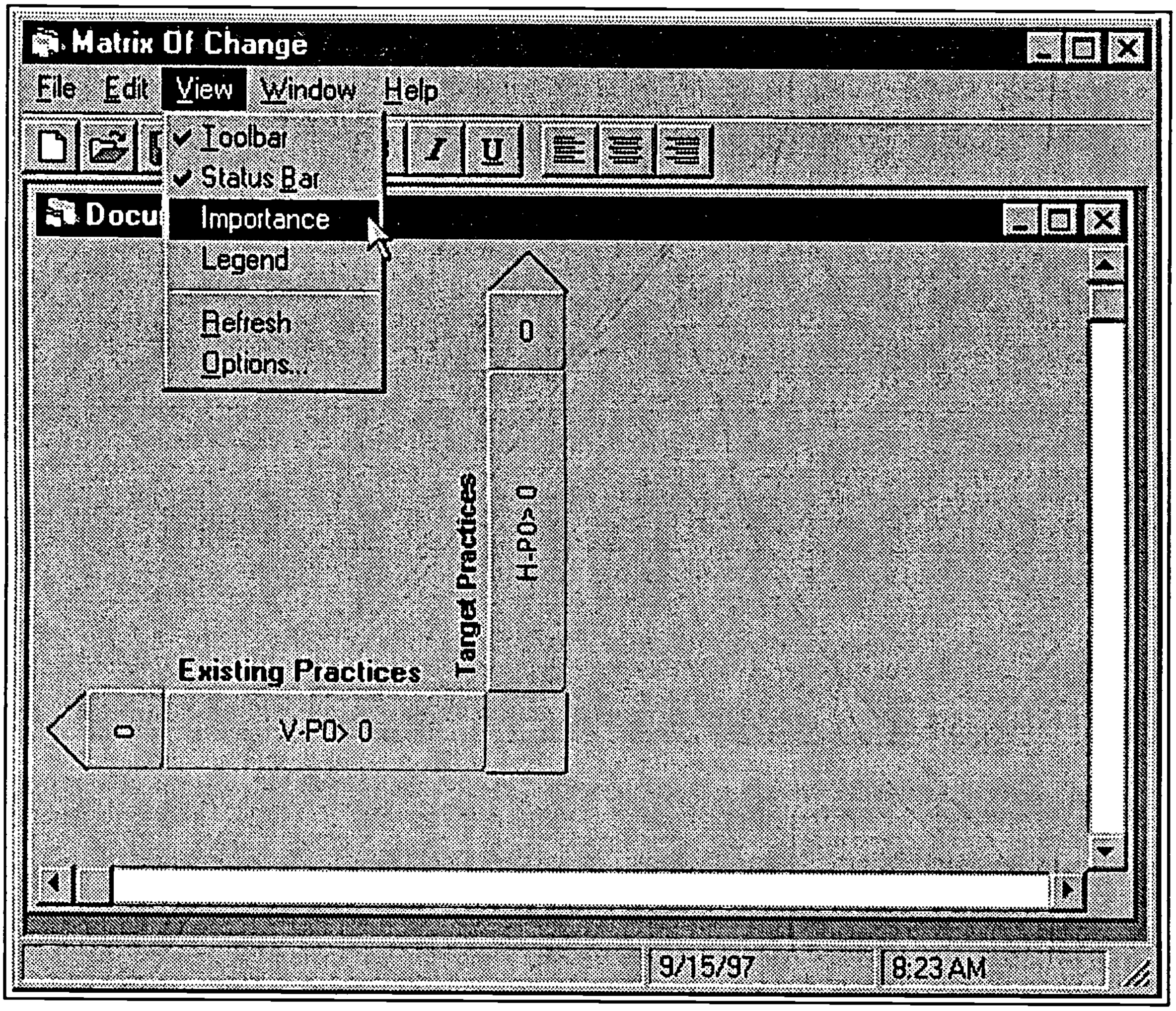

FIGURE A4

BUILDING THE MATRIX AND ADDING THE IMPORTANCE RATING

After adding a few Practices and naming them, the interactions ('+', '-') can be assigned by simply clicking in the correct square (one click will make a plus sign appear, a second click will lead to a minus sign, a third click will clear the interaction). The Importance rating gets filled out by clicking with the right mouse button in an importance-rating field and choosing its value from the pop up-menu.

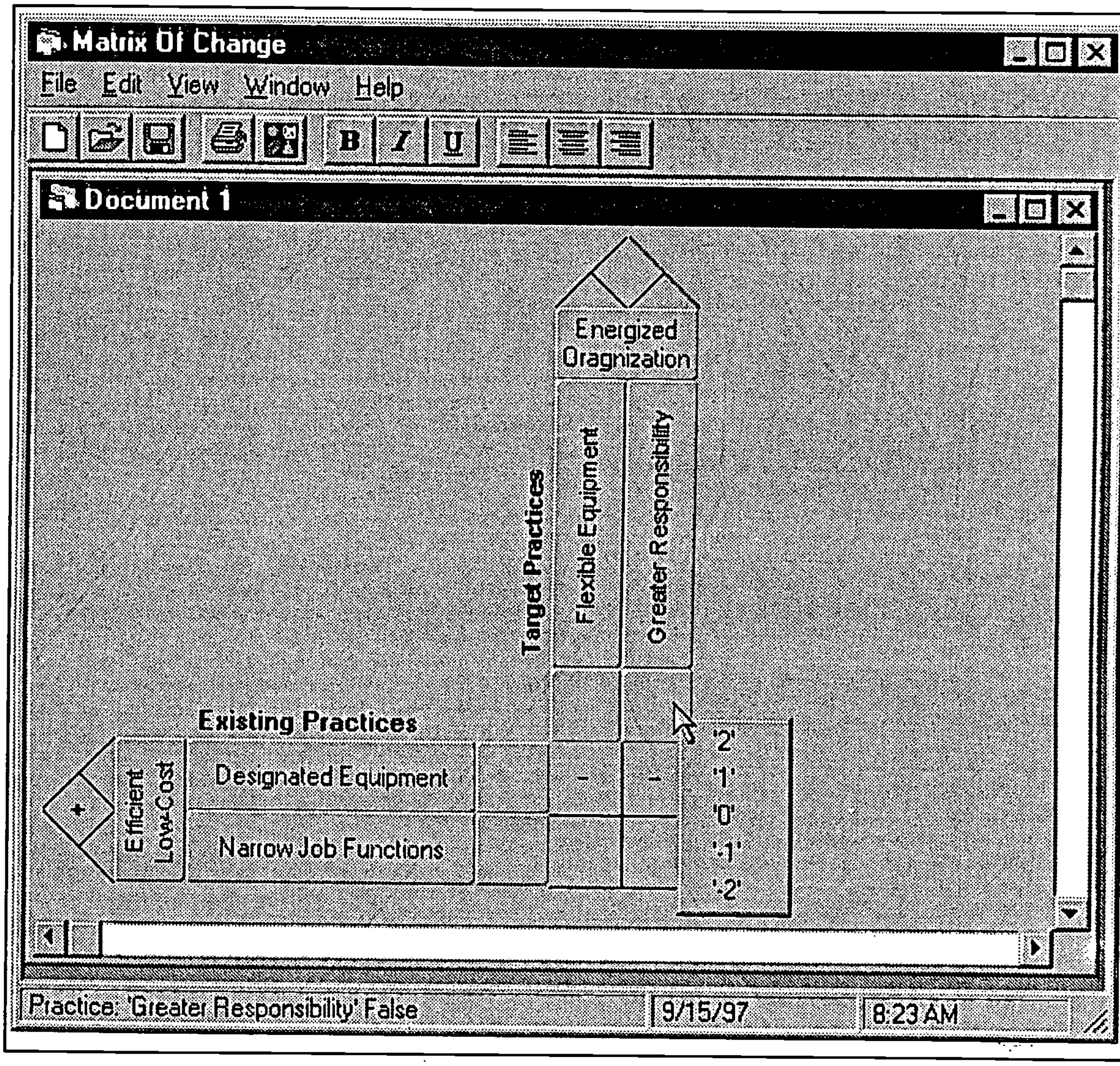

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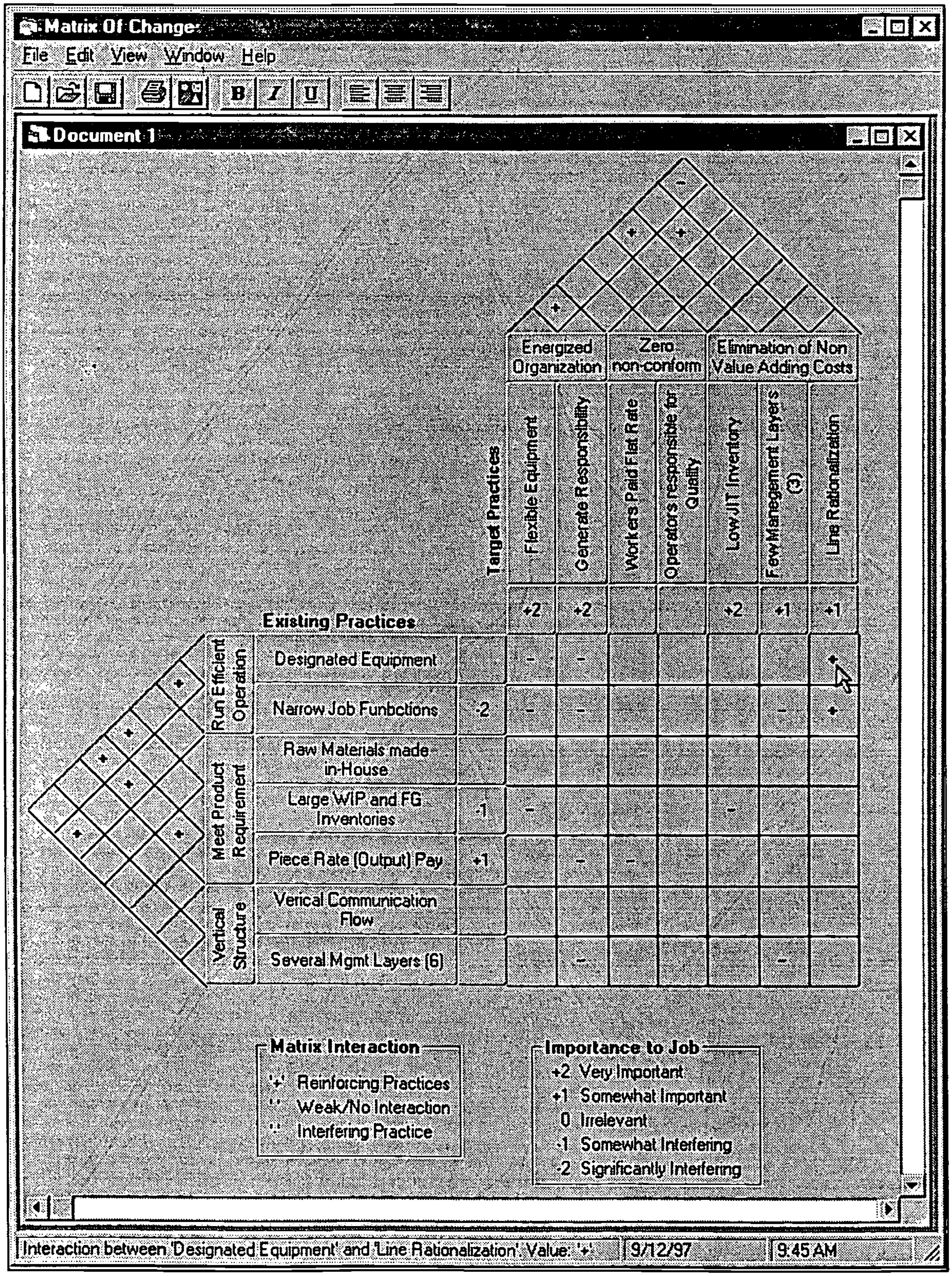
FIGURE A5

THE COMPLETED MATRIX OF CHANGE



MAKING PROJECT GROUPS WORK: THE IMPACT OF STRUCTURING GROUP ROLES ON THE PERFORMANCE AND PERCEPTION OF INFORMATION SYSTEMS PROJECT TEAMS

Brian Mennecke
East Carolina University

John Bradley
East Carolina University

While teams in the business environment are highly structured with clearly defined roles, unstructured project teams in the educational environment suffer from communication and coordination problems. We demonstrated the impact of this lack of structure by providing distinct roles and responsibilities for two sections of an Information Systems class while leaving two other sections without imposed structure. The structured teams not only reported a more positive experience with the project, they also scored significantly better. This paper discusses team structure followed by the methodology and results of the study. The paper concludes with a discussion of the findings, implications for teaching and further research.

INTRODUCTION

In our experience with supervising student project teams in our information systems classes, we have noticed that students frequently do not like working in groups. On the surface, this seems odd. After all, students frequently prefer to do many things in group settings. For example, they often seek out social events such as sports outings, parties, and meals in which the event itself is usually defined by the collection of individuals that make up the group. Further, even when working on assignments, students often seek out others in order to work together in groups –even when their instructors tell them to work on the assignment individually! Nevertheless, there is still something about being assigned to complete a project in a group setting that students do not like.

What is it about project groups that students dislike? Steiner (1972) and others (e.g., McKinney & Graham-Buxton, 1993; Sadler, 1994; Yamane,1996) have suggested that there are extra costs that are involved in working together in groups. For example, when completing a project alone, a student must only engage in whatever activities the project requires. In a simple sense, the activities, or work, required to complete the project is equivalent to the cost the student must pay to achieve success. However, there are additional costs that students must deal with when working in a group. A large part of these additional costs are the transaction costs involved in engaging in group work.[1]

Transaction costs are those costs that arise because group members must spend time and energy communicating ideas and coordinating activities. There are many components to the communication process that can lead to greater transaction costs. For example, to communicate, a message must first be encoded by the speaker and then transmitted to the recipient(s). The receiver(s) of the message must be able to receive the message and then decode its meaning. Throughout this process, there are opportunities for the communication to be corrupted, misunderstood, or lost. When this occurs, misunderstanding will occur which will either lead to problems with coordination or to a need to communicate the message again. In either case, these types of communication problems lead to greater costs for the group members.

A second cause of transaction costs relate to the overhead associated with coordinating group activities. To carry out their activities, group members must schedule times for interactions, allot time for these meetings, and communicate information about the agenda for meetings. In the context of student project teams, these activities involve the coordination of meeting times around student class schedules, extra-curricular activities, and work times. These coordination tasks, in particular, can be quite difficult for students to deal with because members of project groups are often assembled by the instructor in an ad hoc fashion or students self select their groups without considering their schedules or other potential conflicts.

One of the problems that many students face is that they lack experience with working on formal projects in structured group settings. This is not to say that students do not have experience working in groups, but rather that they lack experience with group meetings that are structured and organized. For example, the average business person spends many hours per week in meetings (Panko, 1992). In general, these meetings are well structured. For example, the members of the meeting have defined roles, an agenda is set and announced before the meeting, events and conversations occurring at the meeting are documented in the form of meeting minutes, etc. In general, most students do not have this type of meeting experience.

To examine these issues, we performed a research experiment to identify whether structuring student project teams by assigning roles to group members would help these teams to perform better and have more favorable perceptions about their group experience. In al cases, we expect that the treatment should have a positive impact on performance and perceptions. The next section describes the methodology used in the study. This is followed by a description of our results. The paper concludes with a discussion of the findings and implications for teaching and further research.

RESEARCH METHODOLOGY

Independent and Dependent Variables

This research was designed to assess the impact of assigned roles on group performance and group member perceptions. To do this, we manipulated one independent variable, member roles. In the treatment condition, group members were assigned roles that were relevant to structuring their group interactions (see Figure 1). Groups in the control group were not assigned roles.

Several dependent variables were examined in the study (see Figure 2). These variables can broadly be classified as either performance measures or perceptual measures. The performance measures include project grades and student exam grades. The perceptual measures include group cohesion, satisfaction with the interactions in the group, ratings of group member participation, and satisfaction with the group's performance. The cohesion scale developed by Evans and Jarvis (1986) was used. This scale is designed to measure a group member's attraction to their group. The satisfaction scale was adapted from Green and Taber's (1980) instrument. Several covariates were also examined. These include student ratings of the instructor, student demographic data, student GPAs, student preference for working in structured group settings, and other information about the course. The student's preference for working in structured settings was captured using the Group Procedural Order Questionnaire (GPOQ) developed by Putnam (1979). Perceptual measures and ratings were captured using questionnaires.

Subjects

A total of 106 students were enrolled in the four sections of the course. Of these, 103 students filled out the demographic questionnaire; 56 (54%) were male, 47 (46%) were female. The average age was 23 years. Participants were recruited from four sections of a core business course in information systems (DSCI 3063) taught at a medium-sized university in the southeastern U.S.

Students did not have a choice about whether they were in a treatment section nor about whether they were to participate in the role assignments. Nevertheless, students were not required to participate in the data collection portion of the research (i.e., they were not required to fill out and return questionnaires). To protect anonymity, neither student names nor social security numbers were used for data collection. Rather, students were asked to make up personal identification codes that they could remember and use on subsequent questionnaires. All students were told that a research study was being conducted and that they were not required to participate in data collection nor to turn in questionnaires.

Experimental Procedures

The course was taught by two instructors (the researchers), with each instructor teaching two sections of the course. The treatment, role assignment, was randomly assigned to one of the instructor's sections of the course with the result that the second section he taught (the 12:30 section) received the experimental treatment while the first section (the 9:30 section) was the control. The treatments were counterbalanced in the second instructor's sections (i.e., the first section, the 9:00 section, received the treatment while the second section, the 11:00 section, was the control) to minimize bias introduced by the order in which the courses were taught.

In the sections receiving the treatment, the roles were presented to the student groups during one of the class sessions. During this session, the roles were explained and students were asked to assume one of the roles during their work on the project. Students in each group were allowed to select which role they wanted to assume. Periodically during the semester students in the treatment sections were reminded about the roles. Further, during the middle part of the semester, groups in all sections of the course were required to meet with the instructor to discuss their group, the course project, and to ask any questions they might have. Students in the treatment conditions were reminded of their roles during this meeting and encouraged to continue to engage in their role during the remainder of the semester.

Data was collected several times during the semester. Before groups were assigned and the course project introduced, a demographic questionnaire was administered. This survey asked for information such as the students' GPA, their gender, their preference for using computers, and relateld information. In addition, the GPOQ instrument was also administered at this time. Shortly after this, students were assigned to groups and, for the treatment sections, roles were introduced to the groups. Approximately one week after groups were assigned, the group cohesion questionnaire was administered. This questionnaire was also administered during the middle of the semester and at the end of the semester. In addition, students were asked to complete a questionnaire at the end of the semester that allowed them to evaluate the course, the instructor, and their group and to express their satisfaction with their project and their performance in the group.

FIGURE 1

STUDENT ROLES

Role & Description of Responsibilities

Presider or Meeting Leader:
This person is responsible for keeping the group's meetings on task. This person should develop an agenda for the meeting and let other group members know the agenda. This person should monitor the group's progress during each meeting and identify where deviations from the agenda occur.

File Manager or Project Master:
This person is responsible for making sure that the assignment/project files are secure, that backup copies are frequently made, and that all members have current copies of all assignments. Where necessary, this person is to coordinate the integration of different components of the database project. This person is to maintain frequent contact with other group members to make sure that they have current copies of all files.

Meeting Coordinator:
This person is responsible for knowing the schedules for everyone on the team (a schedule should be turned in to this member immediately), deciding (based on these schedules) about the dates and times of team meetings, and notifying members of the scheduled meetings. This person has the authority to call a meeting as long as no conflicts exist with any member's official schedule.

Intermediary:
This person is responsible for acting as the primary intermediary between the group and the course instructor. This person is to meet periodically with the instructor to discuss the progress of the group (this does not preclude other members from meeting with the instructor). This person should be aware of how the team is progressing on the project and whether there are any major conflicts between any members.

The Course Project

The course is a common body course required by all Business majors (Accounting, Marketing, Finance, Management, Decision Sciences). One half of the course content is the development of a small information system using MS Access. The project for all four sections of this course was selected by the researchers and involved fairly complex programming techniques. Each major part of the project was demonstrated in class, but the students were responsible for using the techniques in the development of their own information system. For most of the students, this resulted in a significant dependence on the other team members. The teams had to work in harmony to complete the project.

In addition, an exam was given to all of the students requiring each to demonstrate proficiency in MS Access as well as familiarity with the project design. Because of the differing degrees of computer literacy and motivation, team members had to help each other prepare for this exam. In other words, the teams spent a great deal of time working together in course-related activities.

RESULTS

The primary variables of interest in this study are student performance on their group's project, performance on an exam related to the group's project, perceptions about cohesion, perceptions about satisfaction, and perceptions about their group. The means for the dependent variables are summarized in Table 1. The results of the analyses related to each of the variables are discussed below.
To examine the project and exam scores, the scores within each section of the course were standardized to facilitate comparisons between different instructors and sections. For example, one instructor provided extra

FIGURE 2

INDEPENDENT AND DEPENDENT VARIABLES

	Variable	Source
Independent Variable	Role Assignment	Group Members Assigned Roles by Instructor
Dependent Variables	Student Evaluation of Group Members	Questionnaire (end of semester)
	Group Cohesion	Questionnaire (beginning, middle, and end of semester)
	Group Member Satisfaction	Questionnaire (end of semester)
	Project Grade	Assigned by Instructor
	Project Exam Grade	Assigned by Instructor
Covariates	Preference for Procedural Order	Questionnaire (beginning of semester)
	Demographic Data (age, gender, preference for using computers, etc.)	Questionnaire (beginning of semester)
	Student GPA	Questionnaire
	Instructor	Assigned

credit on the exam and project while the second instructor did not. No significant differences were observed for standardized exam scores. This indicates that there was no difference in the ability of the individual group members across the treatment condition. On the other hand, the results for the standardized project grades show that groups in the treatment condition scored significantly higher on their projects than did groups in the control condition ($F(1,105)=8.585$, $p.=0.004$). These results suggest that the treatment had a significant positive impact on group performance in the treatment group.

Cohesion was measured three times during the semester in order to examine over time the impact of the treatment on group member feelings about their group. Our expectation was that group members in the treatment condition would develop more favorable perceptions of their group when compared to individuals in the control condition. To make certain that groups were similar when they were first formed, we performed an ANOVA comparing cohesion scores across the treatment condition for the first time interval. The results show that no significant difference existed for cohesion between the treatment conditions when the groups were first formed. However over time, group members in the treatment condition reported significantly higher cohesion than did members of control groups ($F(1,60)=8.864$; $p=0.004$). The trend of the results show that cohesion in all groups fell over time, but that it decreased less in the treatment condition (see Figure 3). Thus, the treatment had a positive impact on group member cohesion.

Several other perceptual measures were also captured and examined. These include satisfaction with the group process, satisfaction with the group's project, and group member ratings of their fellow members' participation in the group. None of these perceptual measures were found to be significantly different. Further, no covariates were found to be significantly related to any of the treatment variables.

TABLE 1

MEANS AND STANDARD DEVIATION SCORES FOR DEPENDENT MEASURES

	Treatment Conditions	
Dependent measures	Control	Treatment
Standardized Project Scores	n=47	n=59
Mean	85.1	90.4
Std Dev.	9.7	8.7
Standardized Exam Scores	n=47	n=58
Mean	87.7	11.9
Std Dev.	84.4	16.8
Cohesion (higher = greater cohesion)	n=24	n=38
Time 1		
Mean	155.0	161.0
Std Dev.	15.3	13.2
Time 2		
Mean	147.5	160.7
Std Dev.	21.5	12.6
Time 3		
Mean	139.5	153.6
Std Dev.	29.9	19.2
Satisfaction with the Group's Process	n=32	n=47
Mean	22.3	6.0
Std Dev.	22.7	5.4
Satisfaction with the Group's Project	n=35	n=50
Mean	15.9	2.8
Std Dev.	16.5	2.7
Rating of Participation	n=47	n=59
Mean	100.3%	100.2
Std Dev.	24.3	21.5

LIMITATIONS

Research of this type is always confounded by extraneous factors that cannot be eliminated. One of the most obvious factors in this study was the use of two instructors with their different teaching styles and interactions with the classes. To minimize this effect, the instructors used the same syllabus, texts, assignments, very similar exams, and even agreed upon the wording of our instructions to the students concerning team activities. Instruction was not found to be a significant covariant. Students also react differently in early morning classes, showing more interest in the later morning classes. We both had one class that met earlier in the morning than the other class, therefore, to minimize this effect, we alternated treatments so one earlier class of one instructor and one later class of the other instructor received the treatment. Class time was not found to be a significant covariant. The classes were also of different sizes, with the treatment classes containing a total of 13 teams and the control classes containing 17 teams.

Another weakness was the degree to which the students adhered to the role assignments in the treatment teams and the degree to which the control teams developed their own structure. To minimize this effect, we reminded the treatment teams several times of the importance of their role assignments, but we could not interfere with the control groups. In spite of this weakness, the difference in group cohesion was significant. Overall, we were in a situation with two male instructors teaching the same material to students drawn from the same pool. We are convinced that the similarities outweighed the differences thus resulting in meaningful findings.

Even though we did find significant differences, there were several other factors that we thought would be significant but were not. For instance, we expected the treatment teams to be more satisfied with the experience than the control group. We asked them questions concerning their general perceptions about their participation, social atmosphere and team function. There were no significant differences. Most of the students perceived their involvement in the teams about the same. However, the cohesion questions targeted specific feelings (I feel involved in what is happening in my group.) and actions (If I could drop out of the group now, I would.) related to team membership which were significantly different. Some unknown factors prevented the general perceptions of the treatment teams from being different than the general perceptions of the control system. We were not able to control these unknown factors.

DISCUSSION

During the course of a semester, group dynamics change drastically. During the first several months, the work is comparatively simple and the students enjoy making new friends. However, during the last month, the pressure to complete the project intensifies and the group members find their time being spent on other classes. This is especially true with those students who are majoring in areas other than Management Information Systems within the School of Business and need to focus on their major courses. Most teams procrastinate until the project due date is unavoidable then schedule lengthly sessions trying to catch up. This is frequently one person on each team that is not as stronly motivated as the others and stops participating or *free loads*. During the last month especially, as the pressure increases, intragroup cohesion can be expected to decrease. This clearly happened in all of our groups. However, based on the measures of cohesion reported above, the treatment groups maintained a higher level of cohesion through the midpoint of the project and then ended the semester in much better shape than the control groups. As expected, the data suggests that added structure contributes to the overall health of groups. Another indication that added structure is a positive factor in health of a group is the quality of the results. The treatment teams produced information systems that were significantly superior to the information systems produced by the control teams.

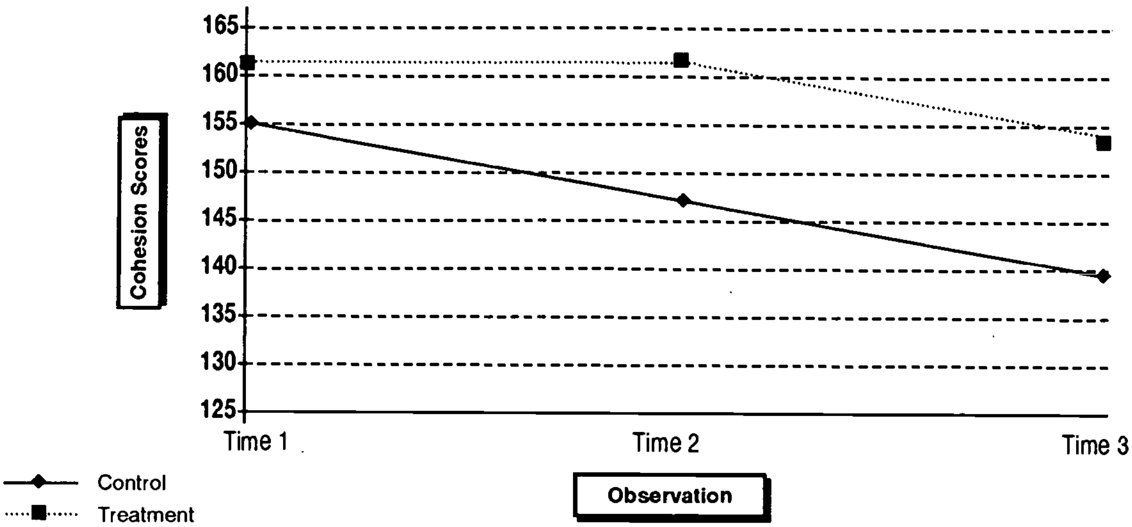
The assignment of roles and responsibilities in a group is one of the factors regularly found in business environments. Increasingly the structure of the academic groups used in this research by the assignment of roles and responsibilites resulted in a significant increse in group cohesion and in the quality of their output. In many courses, the tendency of the instructor is to put the group together and then merely *turn them loose* to perform their assigned tasks. These findings indicate that instructors should do more to provide more internal structure for their groups. They should clarify the tasks that are critical to the functioning of the group, define roles for those tasks, and support the group members that assume those roles.

FUTURE RESEARCH

By the end of the study, one fact had become clear. We were not in the habit of instructing our teams in group dynamics and communication. We usually helped the teams identify team members then graded the teams on the combined activities without instructing them in how to effectively organize, communiate, synergize their ideas, resolve personality conflicts, and otherwise function as a single unit to maximize the benefit of their

FIGURE 3

OBSERVED RELATIONSHIP OF COHESION OVER TIME



varied strengths and abilities. Our next step is to investigate how this instruction can best be accomplished. We are also interested in the use of Internet technologies to increase team performance. One of the problems with student teams is the diversity of their homes, schedules, and outside activities. Several students commute up to an hour for classes and are back home taking care of family responsibilities at the times their team mates want to meet. Having the teams communicate via email, listserv, chat room, etc. would allow the team members to meet at times that are acceptable to everyone. We are interested in how these technologies can best be used and the magnitude of their impact on team performance.

ENDNOTE

1. There are other costs associated with working in groups. For example, Steiner (1972) proposed the idea of process losses associated with group work. A process loss is defined as the differnece between the potential productivity and the actual productivity of the group. There are two sources for process losses: motivation losses and coordination losses.

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A RESOLUTION TO THE TEAMWORK DILEMMA AT A COMMUTER UNIVERSITY: EXPERIENTIAL LEARNING WITH THE SDLC

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While working in teams is beneficial to students, commuter colleges and universities face many obstacles to providing team experiences. At our regional commuter university, students drive 30-40 minutes to class, work full-time, and at an average age of 27 years old, have many family obligations. Further, with downsizing, work weeks have stretched to fifty and sixty hours. Student feedback on course evaluations indicates that while team work is sometimes valuable, coordinating schedules and finding time to commute to meetings makes team work problematic for these students. This paper describes an experiment with an alternative approach. A partner approach was employed for two quarters where two students must each play three roles in a reciprocal way: client, systems analyst, and developer.

INTRODUCTION

Communication between clients and the IS development team continues to be a critical success factor in systems projects, and the most frequently identified reason for systems failure. In an academic setting in which IS majors learn their role in the Systems Development Life Cycle (SDLC), learning to communicate effectively with clients is a critical learning outcome. Project teams theoretically emulate the SDLC for students. However, teamwork in academia has been plagued with problems, particularly those associated with grading and participation . At commuter university with adult students, the team work problem, while no less important, is very difficult. Time to commute, time to meet, and finding a common time on busy schedules makes this important learning outcome very difficult to achieve through traditional teams.

This paper presents a solution implemented for two quarters which seems to have achieved the goals of the team experience and experiential learning experience without the problems encountered with teamwork. Each student is accountable for developing an application in Access. Perhaps the best benefit of this solution has been that students clearly understand the problems associated with client communication. As one student said, "After you get the client's requirements nailed down, the rest is not so bad. I thought Access was going to be the hard part."

PROBLEMS WITH TRADITIONAL TEAMS

In the Principles of Information Systems Development class, project teams had been used to define a problem, develop requirements, perform rudimentary analysis and design, actually develop a project in Access, document the project, and write a paper on the experience. The goals of this team exercise were to provide experiential learning of the systems development life cycle (SDLC) and to enhance database skills by actually using skills acquired through lab assignments to develop a project. Aside from student complaints about the inconvenience of teamwork, lab exams and student peer evaluations provided evidence that participation in the experience was uneven. One or two students typically did almost all the work. Furthermore, students also missed a critical aspect of the SDLC, communicating with a client who must accept the final deliverable. Using two project teams who must interact as client and systems group would further intensify problems adult commuter students face with teamwork.

AN IS PROJECT WHICH REQUIRES PLAYING ALL THE PARTS

For the principles or foundations course in IS, understanding the role of client, systems analyst, and system developer is a major learning outcome. The IS project described requires students to actually play all three roles during the quarter. Each student selects a partner. Students were advised to select partners based on the following criteria: ease of communication, either because of shared work places or because of home locations, common grade goals, mutual interest in project idea, and social compatibility. These self-selected partners then play reciprocal roles as client -systems analyst. For example Student A acted as analyst, interviewing Student B. Student A then submits the problem definition and system requirements for the project described by Student B. B has to "sign off" on the project specifications provided by the A. The grade for Student B's problem definition, requirements, and specifications goes to A and vice versa. Analyst A is also a client whose analyst is student B. After analysis and design, each student develops the project using Access to the specification written by his/her analyst. Then each analyst must "acceptance test" the project against the original specifications. Any changes must be submitted to and documented by the analyst. Thus each student plays each role in the SDLC. The difficulty of communicating requirements, even on a one-on-one basis, becomes apparent.

PITFALLS

A major pitfall to this approach is that some students were unable to create satisfactory specifications in a timely manner. The specifications had to be acceptable for development or they received a grade of R for Redo. Thus, the analyst's inability or lack of effort in creating acceptable specifications could cause another student to delay development. Some students experiencing this situation actually created their own specifications and asked permission to begin development. When a student dropped the course, partners were left at a disadvantage as well.

METHODOLOGY FOR THE PARTNER EXPERIMENT

Project Descriptions

Project descriptions were issued to students and discussed in class.

> Each student will select a database project topic and a partner student. Each student will develop the database project selected, but communicate the project requirements and any modifications made to requirements during development to a partner student. Partner students will write a report on the requirements, modifications, and extent to which the project met the requirements. Every student must act as a partner student and will receive a grade for the Student Partner Report.
>
> Each student must submit (1) a disk with the operational system (2) documentation as described below. Each student must be prepared to demonstrate his or her project to the class.

Students were also given an outline of their final documentation, along with delivery responsibility by role.

Project Timing

During the first three weeks of the quarter, students completed database lab assignments individually while we discussed in class an overview of the development life cycle and then, database design. One class was devoted to an Access lab. During the second week of class, the project was discussed in detail and students selected a partner. In week four, each student acting as an analyst had to submit project specifications including a problem definition statement, system requirements, a sketch of all desired outputs, a definition of required inputs, and file structures with field descriptions. Of the twenty-eight students enrolled in the class, all but five received an R for Redo on the first submission. We continued to work on project specifications, often through individual conferences, until week 6, when development was to begin. Ten minutes were allowed at the end of class twice during this period for partner consultations on any change request forms. Development was to be complete by week 8, and the final project documentation submitted in week 9. The course also involved three exams and a team-based case study analysis. We devoted weeks 8-10 to a more thorough treatment of the SDLC, including the systems analyst's tools and techniques. Most students submitted specifications three times before receiving a grade.

RESULTS

Students reported that the partner approach was helpful in terms of arranging for meetings. Oftentimes, a phone call or e-mail would do when only two people were involved. They also reported that they learned the difficulty of communicating requirements and of capturing requirements. When we discussed the SDLC during the last few weeks of the quarter, their own experience became part of our discussion. Most partners had found prototyping invaluable. Further, as opposed to teamwork, every student was clearly involved in this communication process. Only one student failed to submit a project. The chief benefit of this approach as compared to teamwork was increased participation in all phases of the SDLC by each student.

Some disadvantages for this approach versus teamwork is that partner conflicts and miscommunications seemed harder to resolve than group ones where other team members often take the lead in resolving conflict. One-on-one conflicts were more awkward and harder to resolve. At the end of the quarter, two sets of partners were barely speaking to one other. The camaraderie that often develops in a class as a result of teamwork was also missing, although test study partners seemed to have been formed more during these two quarters. With each student writing a paper on the project he/she developed, a paper evaluating the one for which they served as analyst, and developing a database project, the work load increased for students as opposed to a team effort with one database project and documentation.

TABLE 1
DOCUMENTATION

1. Short paper (Title page, Table of Contents)
   - 1.1 Project Description
   - 1.1.1 System goals or what is to be accomplished, what problem solved
     - 1.1.2 Outputs
     - 1.1.3 Inputs
     - 1.1.4 Processing
     - 1.1.5 Interface
     - 1.1.6 File structures and index fields
     - 1.1.7 Related field(s)
   - 1.2 What was learned from the experience
   - 1.2.1 From partner student perspective
   - 1.2.2 From developer perspective
2. Student partner report
   - 2.1 Initial requirements
   - 2.2 History of modifications to requirements
   - 2.3 Assessment of how well the final project met requirements
3. Appendix
   - 3.1 Database structures
   - 3.2 Report(s)
   - 3.3 Query
   - 3.4 Form

TEACHING WEB APPLICATIONS DEVELOPMENT TO INFORMATION SYSTEMS STUDENTS

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The World Wide Web has been regarded as the most important information technology revolution of the 1990s. It not only has drastically changed the nature of information technology in business and education, but has also imposed a great challenge to developers of information systems (IS) curricula worldwide. To provide IS students with an education that will help them face the challenge of the new technology, Internet-related courses have become an essential component of IS curricula.

Two courses have been developed at Georgia State University for teaching Web applications development to IS students. This paper discusses the structures of and lessons learned from these two courses. An improved course structure is also proposed, based on the experience gained in teaching the courses.

INTRODUCTION

The World Wide Web (WWW or Web) has profoundly changed information technology in the 1990s. It has not only moved information sharing to a global level, but also penetrated deep into the heart of corporate information systems. Commercial Web sites, Intranets and Extranets have taken root in almost all organizations. According to a recent Forrester Report, the Internet commerce software market will reach $3.2 billion by the year 2000 [Forrester 97].

Web applications have drastically changed since the inception of the Web by Tim Berners-Lee at CERN in 1989. In the beginning, Web applications were simple Web pages used mainly for information sharing. Today, Web applications have expanded into the commercial sector and evolved into sophisticated corporate information systems, such as human resource management, order tracking, travel reservation systems, etc. As shown in the same Forrester Report [Forrester 97], some commercial Web projects cost as high as several million dollars.

Consequently, developing Web applications is no longer a simple task of HTML editing. Corporate Web applications must integrate with various operations of the organization and existing corporate data sources. Unfortunately, conventional systems analysis and design methodologies are inadequate to address the unique design requirements of the Web. For example, conventional systems design methods cannot address the issue of Web page design, nor integration of these pages with corporate data sources based on high-level data models (e.g., Entity Relationship models). The conventional methods are also inadequate for translating process models (e.g., workflow models) into the design of navigation methods (e.g., indexing, guided tour, etc.) and server-side code that accesses various data sources. Thus, a course focusing on Web application development is needed.

To meet the demand, we have taught courses on the development of Web applications at Georgia State University. The primary objective is to provide adequate education for our students in order for them to compete in today's job market. Skills in this area are in high demand, as shown in a recent career report in ComputerWorld magazine [Engler 97].

The first section of this paper describes the structures of the two courses and the experience gained in teaching them. A proposed Web application course syllabus based on our experiences is presented in the second section.

WEB APPLICATIONS DEVELOPMENT COURSES

In Spring Quarter 1996, we offered the first Web applications development course. It was offered as an advanced topic course for students with a major in Computer Information Systems (CIS). Enrollment comprised 30 undergraduate students, all of them seniors.

A similar but improved course was offered as an advanced topic course for graduate CIS students in Fall Quarter 1996. The total enrollment of the class was 35, and consisted of second-year graduate students.

Prerequisites for both classes were the same. Students were to have taken a programming course in a high level language (such as C, C++, or Visual Basic) and have completed a database management course.

The Scope of the Courses

As Web applications development deals with a wide range of subjects, there are many different approaches to designing such a course. On one end of the spectrum, the course can be taught with a very strong management orientation. The focus is then on strategic, marketing, and sales issues (e.g., [Carrol 96]). Such a course can be categorized as an Electronic Commerce course. Many schools have developed courses in this category, as listed in the Electronic Commerce Course Page of ISWorld Net [ISWorld Net] and the Internet, Etc. section of Global IS Education [GISE]. Examples of such courses can be found in [Bento], [Dekleva], [Galletta], and [Williams].

On the other end of the spectrum, the course can focus on technical issues such as internetworking, TCP/IP, CGI, and Java programming. Such a course falls into the category of Internet Technology, and can be found in typical computer science curricula. Examples of such courses can also be found in the Internet, Etc. section of Global IS Education [GISE] and other individual course descriptions (e.g., [Beguelin], [Chatterjee]).

We have chosen a third approach and focused on Web applications development. This subject falls in the area of systems analysis and design and cannot be adequately addressed by courses in either electronic commerce or Internet technologies. However, as discussed earlier conventional systems analysis and design does not address the unique characteristics and design requirements of Web applications. Our intent is to fill the void.

The Structure of the Courses

The following discussion is derived primarily from the graduate course because it followed—and took advantage of the experience gained from—the undergraduate course. Appendix A lists the textbooks used and the lecture plan of the course as posted on the Web site for that class (http://cis.gsu.edu/~shong/teaching/cis849/). Appendix B shows the table of contents of the lecture notes of the class.

TABLE 1

SUBJECTS COVERED IN THE COURSE

Topics	Description	Ratio	Assignments
Introduction	WWW, HTML, multimedia	13.3%	Build home pages for each team
Web Servers	HTTP, Web server installation & administration	6.7%	Set up a Web server on home computer
Design methods	Web site design issues, design guide, and design methods for Web applications	23.3%	• Read Web design guides and design methods • Apply the design method to team projects • Present the design in class
CGI programming	CGI programming in Perl, file and database access, database gateway software	16.6%	Complete a CGI programming assignment
Java programming	Network-computing concept, Java and Java Script	13.3%	Complete a Java applet assignment
Advanced topics	Web security, Intranet, legal issues, including guest lectures	20%	• Read selected articles • Conduct a literature survey on a selected topic.

The class comprised four components: lectures, team projects, individual assignment, and exams. All lectures were conducted in a room in which the instructor and students had computer workstations. The topics and time ratios of the lectures are listed in Table 1.

Team Projects

The team projects lasted the entire quarter. Each team consisted of at most three team members who were responsible for finding a local company that would sponsor a Web project. The team conducted several interviews with sponsors at the beginning of the quarter to determine project requirements. During the quarter, teams maintained close relationships with project sponsors, reporting progress and obtaining feedback.

By the end of the quarter, each team gave a formal, on-site presentation to their sponsors, in addition to a class presentation. Each team also prepared thorough documentation for their sponsor. Prior to the project presentation, the instructor wrote a letter to thank each sponsor and to request a written, sealed evaluation of the team.

There were two specific project requirements. One was that the project must be database-driven. (That is, all dynamically changed data had to be stored in a database.) The other was that two interfaces had to be provided, one for public browsing and another for administration. The latter was a protected interface for authorized users only, and was designed for maintaining the application once the project was completed. The maintenance pages allowed a sponsor to use a Web browser to access the database and to update information without coding.

The feedback received from the sponsors on the maintenance pages was very positive. They felt that the facilities these pages provided greatly simplified updates and reduced maintenance costs.

Computer Software and Hardware

A special Web server that provided the applications and exercises need to run CGI programs was set up for the class. As with most universities, Georgia State University does not give students full access authorizations to its Web servers for security reasons. This restriction was also true for the project sponsors that had their own Web servers. Thus a standalone, dedicated Web server was an essential component of the class.

The hardware for setting up such a Web server does not have to be a high-powered computer. The computer we used was a Pentium 66 with 16 MB memory and a 640 MB hard drive. It was connected to the Computer Information Systems department's Token Ring network. We found that this configuration was adequate for supporting both classes.

Database gateway software (Allaire's Cold Fusion [Cold Fusion]) was installed on the Web server to reduce the amount of CGI programming necessary. Cold Fusion allows the development of database-driven applications without CGI programming, requiring knowledge only of HTML and SQL. As discussed earlier, developing Web applications was the main focus of this class, and adopting this software tool allowed the students to focus more on the design issues than coding.

As shown in Table 1, students were asked to set up Web servers on their personal computers. The database gateway software Cold Fusion [Cold Fusion] and several popular Web servers (e.g., [WebSite], [ZBServer]) provide 30- or 60-day free evaluations. Setting up a Web server at home involved no additional cost to the students. There were several reasons for such a requirement. First, students could acquire the knowledge and skills of Web server installation and administration. Second, it allowed students to develop and test their applications on their own computers before uploading the applications to the Web server. Third, a large number of the students were part time and allowing them to work remotely reduced commuting time. Finally, since most work was done at home there was less need for server administration, and no need for a dedicated computer lab. Students developed their applications at home, then used FTP to upload their applications to the server.

Individual Exercises

Two small programming exercises were assigned to each student. In addition, each student was also required to conduct a literature research on a selected topic and write a survey paper. Four outstanding papers were selected and presented in class. As shown in Appendix B, the papers discussed Internet security, Intranet, and legal issues.

Outcomes and Lessons Learnt

Students in both classes encountered two major difficulties. The first difficulty was collecting project requirements from project sponsors. This difficulty was experienced more often in projects involving the development of commercial Web sites, whereas Intranet applications were usually well defined.

Most corporations have found it difficult to translate their business success to cyberspace. Their initial attempts, prompted by a tidal wave of other companies moving onto the Web, were sometimes intended merely to establish an Internet presence—any Internet presence. These attempts often lacked the necessary understanding of the power and limitations of the Web. The lessons we have learned from the mistakes of the past suggest that education on issues relating to electronic commerce is required if the next generation of IS graduates is to successfully exploit the power of the Web.

The second major difficulty experienced by the project teams was adopting and applying analysis and design methods. Because the Web has evolved so rapidly, there were few design methods available when the two courses were offered. Those methods that were available were extensions of design methods for hypermedia applications, such as the RMM method proposed by Isakowitz and his colleague [Isakowitz 95]. Our solution was to define an analysis and design method by combining features in the RMM method with conventional analysis and design methods [Hong 93]. However, the students found it difficult to apply the design method because of impedance between selected analysis and design features. The problem calls for a well-defined and well-tested method for developing Web applications.

We strongly recommend adopting a Web application development tool. No such tool was adopted in our first class; students manually wrote CGI programs to produce dynamic Web pages. Cold Fusion was adopted for the second class, which made significant differences in both the complexity and quality of the projects. (Please refer to the project pages of those two classes [CIS485 Proj] [CIS849 Proj].)

Overall, students viewed the two classes as very valuable. Many students from the classes are now working on Web-related projects in their organizations. Altogether the project teams developed twenty-three Web applications for companies ranging from small businesses to Fortune 100 companies. More than half of the projects have been converted into official Web sites. The student teams were highly motivated and made a great effort to produce high quality applications beyond the expectation of project sponsors, as reported by the sponsors in their evaluation letters.

A PROPOSED COURSE

There is more than one way in which Web applications development can be incorporated into CIS or MIS curricula. One way is to integrate the subject into systems analysis and design courses. The advantage of this approach is that existing curricula do not need to be changed and the subject can be integrated into the instruction of conventional systems analysis and design.

We propose a different approach, a separate course for Web applications development. We believe that there are too many topics within this area to be covered as a part of another course. A separate course gives sufficient time to treat the topics of developing Web applications in reasonable depth.

Prerequisites

There are several prerequisites for the proposed course. First, students should have completed a database course. As databases are an essential component of Web applications, familiarity with database management and SQL is necessary.

Second, students should have taken at least one programming course, such as C, C++, or Visual

Basic. These skills are necessary for writing CGI programs, and the Web applications development course should not attempt to teach introductory programming. If a software tool like Cold Fusion [Cold Fusion] is adopted for this class, the programming prerequisite could be optional.

Another optional prerequisite would be a course in systems analysis and design. If students have already had such a course, the discussion of design methodology could build upon their established knowledge of systems analysis and design.

Objectives

This course should focus intently on the development of Web applications. Ideally, when students have completed this course they should be qualified to pursue jobs as Webmasters, Web application developers, or related careers.

Computer Software and Class Lab

Two types of computer software are essential: a Web server, and database gateway software or a Web application development tool. The Web server is used to host all student projects and exercises. Our experiences suggest Microsoft Internet Information Server on a Microsoft NT workstation. The selection of this platform is based on its simple administration and low cost (IIS is free with NT server). A standalone Web server gives students the capability of running Web applications with minimal constraints.

A database gateway software or development tool (e.g., [Cold Fusion], [IntraBuilder], [JDesigner], [NetDynamics], or [Visual InterDev]) helps lower the learning curve and reduce the time required for coding Web applications. Such software is very critical for schools in quarter systems. Our experience has strongly suggested that adopting such software tools allows students to focus on design instead of coding.

Server side database software is not required. In our classes, we allow students to develop their applications using Microsoft Access. The selection of Access is based on its wide availability and low cost. Our students first created a database on a personal computer, then uploaded it to the Web server to support their applications. The major benefit of such an approach is that it requires no database administration such as creating user accounts. We used this approach for the two classes and have not had any problems with it.

A designated lab for the class was not necessary because students could access the Web server from any computer that had Internet access either directly or remotely. However, the room for such a class must have at least an instructor workstation with Internet access. This allows the instructor to demonstrate various Internet technologies.

The cost for setting up an adequate Web server for such classes is estimated as follows:

Internet connection:	free (assuming the school has already had Internet connection)
Web server hardware:	$2,000.00 to $2,500.00 (e.g., a Pentium Pro 200 with 64 MB memory and 4.0 GB diskspace)
Operating system:	$400.00 and up (e.g., $399.95 for Microsoft NT Server)
Web server software:	$0.00 to $800.00 (e.g., free for Microsoft Web server and Netscape Web server, or up to $790.00 for WebSite Professional 2.0)
Web application development software:	$500 to $1,000.00 (e.g., Cold Fusion, InterDev, IntraBuilder, etc.)

Thus, the total estimated cost for computer software and hardware would be between $2,900.00 and $4,700.00. Note that database software is not included in the list. It assumes that small databases such as Microsoft's Access are available at no additional cost.

Course Topics

Table 2 shows the major topics of the proposed course. It is based on the experience gained from the two classes as discussed earlier.

TABLE 2

PROPOSED COURSE TOPICS AND LECTURE HOUR RATIOS

Topics	Description	Ratio	Assignments
Introduction	Discusses WWW, HTML and introduces Web applications Intranet and Extranet	10%	Build and maintain their a team project Wed site
Web Servers	Introduces HTTP and Web server set up and administration	10%	Set up a personal Web server on student home PCs
Electronic Commerce	Discusses issues related to strategic planning, marketing, and sales in cyberspace	15%	Study commercially successful Web sites
Design of Web Applications	Introduces design issues and design methods for Web applications	25%	Apply the method to the design of team projects
Web application implementation	Introduces CGI programming, Java Script, Java, and tools for developing Web applications	25%	Complete a CGI programming assignment
Advanced topics	Discuss issues related to Web security, and Intranet	15%	Literature research project

Compared with the topics listed in Table 1, there are several changes as explained below:

1. We decreased the time for introduction. We assume that students already have some familiarity with HTML and setting up simple home pages. The introduction should focus on advanced HTML tags such as form tags.
2. The time slot for the discussion of Web servers has been slightly increased. Several popular Web servers, such as WebSite [WebSite] and ZBServer [ZBServer], provide simple, straightforward installation procedures. They all supply GUI administration tools that make the administration rather easy. These Web servers usually allow students to download a 30- or 60-day free evaluation copy.
3. A new topic, electronic commerce, has been added. As we discussed earlier, our experiences have shown that it is important to have basic knowledge of cyberspace strategies, marketing, and sales. Such knowledge stimulates discussions between students and their project sponsors, and helps identify critical areas contributing to the commercial success of Web applications.
4. Lectures devoted to the discussion of Web applications development have been slightly increased. Given the lack of off-the-shelf methods, instructors may have to combine conventional systems analysis and design methods with design methods of hypermedia applications.
5. CGI and Java programming remains, but with decreased time. It is believed that students should understand the concepts and techniques of Internet programming in terms of CGI and Java. Although software tools could eliminate the need for coding in this class, knowledge and basic skills in CGI and Java programming lay a foundation for students who want to pursue advanced Internet applications programming in subsequent studies.
6. The final section of the lecture would be reserved for discussing development in WWW. The topics covered would be left to the discretion of instructors.

Projects

Team projects should an important cornerstone of the class. There is a high demand for setting up Web sites and developing Web applications; therefore students should have no problem finding suitable projects. The project should be designed to accomplish several objectives:

1. Expose students to challenges in a real world setting.
2. Apply processes and techniques to the analysis and design of Web applications.
3. Develop basic skills in the development of Web applications.
4. Gain an in-depth understanding of the development of Internet technology and industry trends.

As class projects can easily be shown to prospective employers, the projects may strengthen students' resumes as examples of "real world experience." Having such international exposure can motivate students to do their best. Instructors must be sure to maintain the projects on-line after the class ends and to keep a close eye on the quality of the projects. For instructors, such project Web pages can be a good promotion for the class.

CONCLUSION

We have described the Web development courses developed and taught at Georgia State University. We have also proposed a similar course based on the experience we gained in those two courses. Our experiences have shown that such courses are very important for preparing IS students facing the challenge of new technologies and competing in today's job market.

Preparing for such a class is time-consuming. It requires instructors to develop both lectures and lab exercises. Adequate curriculum development time must be allocated. Instructors must have sufficient time to reeducate themselves about the new technology and become Internet literate.

The cost for computer resources for such a class is comparable with other IS courses. If instructors have strong technical backgrounds, administrating the class Web server should not be a major problem. In the two classes taught at Georgia State University, the instructor performed all administrative tasks after the Web server was set up with the help of a computer support technician. The complexity of administrating Web servers has been reduced greatly by newly released server software.

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[Galletta] Dennis Galletta, "Commerce on the Information Highway," http://www.pitt.edu/~galletta/commerce.html, Joseph M. Katz Graduate School of Business, University of Pittsburgh.

[GISE] Global IS Education Web site, *Course Syllabi* , http://gise.org/SYLLABI.htm.

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[IntraBuilder] IntraBuilder, Borland International Inc., World Wide Headquarters, 100 Borland Way, Scotts Valley, CA 95066 , http://www.borland.com/intrabuilder/.

[Isakowitz 95] T. Isakowitz, E.A. Stohr, & P. Balasubramanian, "RMM: A Methodology for Sturctured Hypermedia Design," *Communications of the ACM*, Vol. 38, No. 8, August, 1995, pp. 34-44.

[ISWorld Net] Electronic Commerce Course Page, http://www.isworld.org/isworld/ecourse/home.html, Editor, Blake Ives, ISWorld Net.

[JDesigner] JDesignerPro, BulletProof Corporation, 15732 Los Gatos Blvd. #525, Los Gatos, CA 95032, http://www.bulletproof.com/.

[NetDynamics] NetDynamics, NetDynamics, Inc., 185 Constitution Drive, Menlo Park, CA, http://www.netdynamics.com/.

[Visual InterDev] Visual InterDev, Microsoft Corporation, http://www.microsoft.com/vinterdev/.

[WebSite] WebSite Server, O'Reilly Software, http://software.ora.com/.

[Williams] Russ Williams, "A Brief Introduction to the Internet and Electronic Commerce for Small Businesses", http://gwis2.circ.gwu.edu/~rwill/sbrc20.htm, Electronic Commerce Resource Center for Small Businesses and SME's, George Washington University, Washington DC.

[ZBServer] ZBServer, ZBSoft Corporation, 1917 Wilson Avenue, Madison, IN 47250, http://www.zbserver.com/.

APPENDIX A
CIS 849 SYLLABUS (EXCERPT)
FALL QUARTER, 1996

Textbook

Required textbooks:

- [S] Lincoln D. Stein, *How to Set Up and Maintain a World Wide Web Site: The Guide for Information Providers*, 1995, Addison-Wesley Publishing Company, ISBN 0-201-63389-2
- [HSS] A.V. Hoff, S. Shaio, and O. Starbuck, *Hooked on Java: Creating Hot Web Sites with Java* Applets,, 1996, Addison-Wesley Publishing Company.

Optional textbooks:

- [B] T. Boutell, *CGI Programming in C & Perl*, Addison-Wesley Developers Press, 1996, ISBN 0-201-42219-0
- [EH] G. Eddy & B. Hausch, *Web Programming with Visual Basic*, Samsnet, 1996, ISBN 1-57521-106-8

Selected Readings Reserved and on the Web.

COURSE PLAN

9/25 Class Introduction & Team Project Discussion
Team Project Assignment
Research Paper Assignment

9/30 Introduction to the Web & HTML
Reading: [S] ch 1, 2, 5;
[Readings] 1, 2, 3, & 8

10/2 Web Server Installation & Configuration
Reading: [S] ch 3
Project plan due

10/7 Creating Multimedia HTML Documents
Readings: [S] ch 6

10/9 Introduction to CGI Programming
Readings: [S] ch 8, 9
Requirements document due

10/14 Web Page Design Guideline
Readings: [S] ch 7, [Readings] 4, 5, 6 & 7

10/16 A Design Method for Web Applications (1)
Readings: [Readings] 4, 5, 6 & 7

10/21 A Design Method for Web Applications (2)
Middle term research paper due

10/23 CGI Programming (1)
Reading: [B] or [EH]

10/28 CGI Programming (2)
Reading: [B] or [EH]

10/30 **Project design presentation**
Project design document due

11/4 CGI Programming (3)
Reading: [B] or [EH]

11/6 Introduction to Java (1)
Reading: [HSS] ch. 1 & 2
[Readings] 9 & 10

11/11 Introduction to Java (2)
Reading: [HSS] ch. 3 & 4

11/13 Web Security
Reading: [S] ch 4

11/18 Introduction to Intranet
Reading: TBD

11/20 **Project preparation**

11/25 **In Class Exam**

11/27 - 11/29 Thanksgiving Holidays

12/2 Special topics

12/4 Project presentation,
6:00 p.m., Wednesday,
December 4, 1996

FINAL PROJECT REPORT DUE

APPENDIX B
CIS 849A Lecture Notes Outline

1. Introduction to WWW
2. Introduction to Basic HTML Tags
3. Introduction to Web Servers

4. Advanced HTML Features
   - Try the form submission example
5. Introduction to CGI Programming
   - Try a simple searchable document using ISINDEX
   - Try the Hello. World CGI script
   - A CGI script printing all environment variables
   - A form submission example and its source code
   - CGI4VG for CGI Programming in Visual Basic developed by Kevin O'Brien, which according to the author, supports standard I/O.
6. Web Application Design & Evaluation
7. Web Application Design Methods (Part I)
8. Web Application Design Methods (Part II)
   (See handout)
9. Advanced CGI Programming
   - How to set up a personal WebSite Server for running Perl scripts
   - Download the cgi-lib.pl
   - Download the CGI.pm library
   - Form process example and its CGI code
   - CGI-LIB Form process example and its CGI code
   - CGI-LIB file upload example and its cgi code
   - CGI.pm Form process example and its CGI code
   - More script examples created with CGI.pm by Lincoln Stein
10. CGI Programming: Files & Databases
    - The simple counter Perl code (18 k zipped)
    - Tutorial & Example Applications came with the Cold Fusion 2.0
    - Example applications came with the Cold Fusion 2.0
    - Install & test Cold Fusion at a home PC and the Student Information System Example (33 k zipped)
    - Test-drive the Student Information System example
    - An IDC file example (sample.idc) for MS IIS
    - A HTX file example (sample.htx) for MS IIS
11. Introduction to Java
    - Download the Java Developer's Kit from JavaSoft
    - Timothy Arnold's Java Lab
    - The lecture examples (pkzipped, 15k)
    - Test the lecture examples
12. Introduction to JavaScript
    - JavaScript Authoring Guide from NetScape Communications Corporation.
    - Lecture JavaScript Examples (pkzipped, 4k)
    - Test the lecture JavaScript examples
13. Special topics: Application Design Discussion
    CGI Programming in Visual Basic by Shannon Wade
    - Shannon Wade's Home Page for CGI Programming in Visual Basic
    - Shannon Wade's Visual Basic CGI Example Source Code (pkzipped 5k). It contains three Visual Basic files
14. Internet Security 1 by Pi-Lien Cheng
    Internet Security 2 by Rick MacConnell
15. Intranet by Mary Depledge, Paul Lytle, & Nethaniel St. John
16. Legal Issues in Internet by James Kohm
    Developing Intranet applications by Alessandro Marsili

IS THERE A DIFFERENCE OR WHO'S DOING WHAT? A COMPARISON OF AACSB ACCREDITED AND NON-ACCREDITED SCHOOLS' INTERNATIONALIZATION OF THE INFORMATION SYSTEMS CURRICULUM

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Thunderbird - The American Graduate School

The intent of this study is to provide insight as to where schools are going in terms of their success in internationalizing the information systems (IS) curriculum, testing to see if, in fact, The American Assembly of Collegiate Schools of Business (AACSB) and other external forces are evidencing any effect. This research reports the findings of an empirical study specifically designed to evaluate trends toward internationalization of the IS curriculum. The reported results reflect a five year time horizon as well as a comparison of AACSB member accredited schools to AACSB member schools that are not accredited. This study provides the first comparison of IS internationalization curriculum trends over time with emphasis on AACSB accreditation. This work also provides IS educators with a benchmark and knowledge of overall trends with respect to information systems curriculum development.

INTRODUCTION

Review of the past five to seven years in both the research literature and curriculum design finds a concerted effort to incorporate an international dimension into the existing information systems (IS) curriculum. Prior to 1990, there is a notable lack of international focus in the IS research. Those studies that examined international IS issues were limited and fragmented, not growing a defined stream of research based on previous empirical works. A similar situation existed with respect to IS curriculum. The traditional IS curriculum was taught from a domestic (US) perspective with little or no emphasis on international issues and problems and opportunities encountered by multinational firms. No doubt this was in part due to the dearth of textbooks available for introductory IS courses with any international content. During this same period, curriculum guidelines established through the work of the Association of Computing Machinery (ACM), Data Processing Management Association (DPMA), the International Federation for Information Processing (IFIP), and other recognized organizations were also void of guidelines to include international content in the IS curriculum.

Since 1990, much has changed. Different course models focusing on both undergraduate and graduate programs have been developed (Deans, Loch, and Roche, 1993). Many schools have followed the lead in implementing some form of an IS course with international content. Much attention has been paid to the evolution of international IS curriculum issues at annual IS conferences (e.g., Information Resources Management Association, and the International Academy for Information Management). The establishment of CIBER institutions (Center of International Business and Economics Research) around the country has made available significant financial resources to conduct faculty development in international business and specifically in international IS to interested and motivated parties. Major improvements are evidenced in recent textbooks, which incorporate international topics throughout the text rather than relegating the topic to the last chapter as an after thought. The AACSB, for example, called for the incorporation of an international dimension in the curriculum for years; it is only recently that there seems to be more teeth to this directive. One question that arises is the extent to which these efforts have been successful?

BACKGROUND LITERATURE

Recent literature indicates an increased interest in business school curriculum in general over the past few years. The international dimension has emerged as one of the key drivers of curriculum reform. The emergence of the World Wide Web (WWW) and increased access to information on the internet has changed the dynamics of curriculum design. The internet and WWW have opened doors and opportunities not before possible on an international scale. Business schools across the board have implemented revised curriculum plans that incorporate and integrate information technology throughout the curriculum. These factors have made it more difficult to define the international dimension of the IS curriculum and its evolution over time.

A comprehensive review of the literature focusing on IS curriculum in general as well as the evolution of the international component over time can be found in Deans and Loch (1996). The Deans and Loch (1996) research provides the foundation work from which this study is an extension. The literature review traces the origins of the international IS component and describes the development and implementation of individualized international IS courses as well as other alternative approaches for internationalizing the overall curriculum. Previous studies have also reported trends toward internationalization efforts in foreign schools of business.

In this paper we extend this literature base to explain some of the results of recent efforts to internationalize the IS curriculum and specifically evaluate the impact of external forces with particular emphasis on the AACSB. No study to date has looked at the impact of various influences on international IS curriculum trends and specific course offerings over time. We hope this study will shed some light on these issues and provide insights for other schools in the process of making similar decisions about the future direction of their IS curriculum.

In summary, this study contributes to the IS curriculum literature, differentiating between types of institutions and their respective responses to the trend toward internationalization of the IS curriculum. The findings highlight the impact that external forces have had on the extent to which respective institutions have internationalized the IS program. The findings also offer tangible feedback to interested institutions to compare themselves across groupings. Moreover, as this is the first study of this kind, it also serves as a baseline for future studies.

METHODOLOGY

The methodology for this study followed the design of the first survey of US Schools of Business by Goslar and Deans (1994). This study reports the findings of a follow-up survey that provides a direct comparison of these schools' internationalization progress over a five year period. The sample was segmented into three categories: 1) Leaders as defined by their early involvement in internationalizing the IS curriculum 2) AACSB member schools that are accredited, and 3) AACSB member schools that not accredited.

Sample

The total sample size numbered 647; those schools who responded to the 1990 survey comprise the leaders group. The leaders group represented 112 institutions or 17% of the total sample. Of the total sample, 44.5% were accredited institutions versus 55.5% non-accredited. However, two-thirds of the leaders group was comprised of AACSB accredited institutions. If one looks at the sample minus the leaders group, the balance of accredited to non-accredited schools shifts markedly. Table 1 provides the details of the sample by segment.

Research Questions

Three research questions are the focus of this study and are examined in light of the three groups.

1. What are the major forces driving IS curriculum reform toward inclusion of an international dimension? How have these influences changed over time and how are these groups responding?
2. What strategies and teaching alternatives are being implemented to accomplish the objectives of internationalizing the IS curriculum? Do these differ by groupings, demonstrating effects of external agencies, and if so, how?
3. How are these different groups responding to the internationalization process:
   a) development of separate international IS courses?
   b) placing importance on internationalizing the IS curriculum? And
   c) future plans toward internationalization?

These research questions reflect the exploratory nature of the study. Very little is currently known about these issues since the incorporation of international IS content into the curriculum is relatively recent. Rapid changes in information technology and overall curriculum design add complexity to the research questions. This study is intended to shed some light on current trends and expose issues and relevant considerations that may not have surfaced previously. Identifying these future research paths and curriculum directions are inherent in the design of this work.

Questionnaire

The instrument was comprised of four sections, all of which were taken from the first survey. Respondents evaluated a list of twelve influences identified as drivers for international IS curriculum development on a scale of 1 to 7 (1 = not important and 7 = extremely important). This list is presented in the results section in Table 4. Similarly, a seven point scale (1=very effective; 7=very ineffective) was used to evaluate the effectiveness of international IS teaching alternatives (i.e., a separate international IS course, international topics integrated into the core IS curriculum, international topics integrated into only select IS courses). The third section included several questions designed to evaluate perceptions toward internationalization of IS curriculum that were evaluated on a seven point scale (1= strongly agree and 7= strongly disagree). An open-ended question intended to identify major themes and topics considered essential for internationalizing the IS curriculum was incorporated. Finally, a number of variables describing current IS program characteristics and future plans were included.

Respondents and Data Analysis

The questionnaire was administered by mail and sent to 647 business schools, 112 constituted the leaders group, 213 and 322 represented accredited and non-accredited AACSB members respectively. Of the 112 leaders institutions surveyed, 66 questionnaires were returned representing a response rate of 59 percent.

TABLE 1

SAMPLE CHARACTERISTICS BY ACCREDITATION

	Total Sample	Leaders	AACSB Accredited	Non-accredited
Accredited	288 / 44.5%	75 / 67%		
Non-accredited	359 / 55.5%	37 / 33%		
Total N	647	112 / 17.3%		
Total N - leaders	535		213 / 39.8%	322 / 60.2%

Eighty-two or 38.5% of the accredited schools responded whereas only 46 or 14.3% of the non-accredited schools participated. A profile of general characteristics of respondents from both studies is presented in Table 2. A discussion of these variables and their relationship to the study results is presented in the results and discussion section.

Data analysis is primarily descriptive. Frequency distributions and two-tailed t-tests are reported. These findings are general in nature, suggesting direction for more in-depth analytical work in future studies.

RESULTS AND DISCUSSION

All four groups' descriptive characteristics varied little at first glance. For example, the proportion of schools offering undergraduate and graduate programs was comparable. The single exception was the non-accredited institutions' lack of doctoral programs. When one looks beyond the averages however, a more interesting story unfolds. Table 3 highlights the story. While the percentage of program internationalized is within one point between the groups, 24% of both the non-accredited and the accredited respondents indicated that their respective programs were zero internationalized. One respondent from an accredited institution commented "Our curriculum is still in the dark ages of IS. We have yet to discover its international dimensions." In contrast, 19% of the leaders group indicated that their programs remained sans international. Based on most other indicators, the accredited group seem to be farther along in the internationalization process than even the leaders group. This may in part be explained by the fact that the leaders group is comprised of 2/3 accredited institutions, 1/3 non-accredited institutions. One also observes that the accredited and leader schools on a whole seem to offer larger programs, with a smaller percentage of them offering only 2 or fewer courses at the undergraduate level and 1 or fewer at the graduate level. This observation is of import as program size is likely a factor of the ability to offer stand-alone courses, one of three teaching delivery channels we examine shortly.

TABLE 2

GENERAL CHARACTERISTICS OF ALL GROUPS

	Survey 1 (1990)	Leaders (1994)	Accredited	Non-accredited
Offer an IS degree program in the following levels:				
Baccalaureate:	75%	77%	68%	70%
Masters:	30%	27%	40%	28%
Doctoral:	16%	17%	18%	2%
How many IS courses are currently taught? (mean/std dev) Undergraduate	3.18 (1.76)	2.42 (1.93)	3.56 (4.63)	1.33 (1.34)
Graduate	4.04 (3.49)	2.35 (3.05)	3.62 (3.23)	2.10 (1.73)
Number of IS faculty (mean, std dev)	7.02 (5.70)	5.14 (3.6)	6.60 (6.9)	5.38 (5.78)
# of faculty with intl background &/or training (mean, std dev)	not asked	2.10 (2.8)	2.31 (2.66)	1.52 (1.52)
Percentage of IS program internationalized (mean)	not asked	16% (17%)	17% (25%)	16% (23%)

TABLE 3

COMPARISON OF GROUPS BEYOND THE AVERAGE

	Undergraduate	Graduate	Faculty Background	% Schools with Programs ZERO Internationalized
Non-accredited	54%<= 2	50%<= 1	81%<=2; 29%=0	24%
Accredited	43%<=2	31%<=1	68%<=2; 19%=0	24%
Leaders	50%<=2	44%<=1	76%<=2; 24%=0	19%
Survey 1	41%<=2	50%<=1	Not asked	Not asked

The percentage of faculty with international background and/or training also presents some interesting differences amongst the groups. Only 19% of the accredited schools indicated that there faculty had no international background whereas 29% of the non-accredited schools' faculty had none. The leaders group again places between the two groups, with 24% of the leaders group lacking faculty with experience or training. These numbers are rather surprising, especially for a group of institutions whom we've considered leaders. It suggests that there is much work still to be done in the internationalization process.

Major International IS Topics And Themes

Respondents were asked to prioritize the five most important topics for the International IS curriculum. Based on our subjective judgment, Table 4 provides a listing in priority of the top five topics by group. We've also included responses from the first survey as a comparison over time. There is strong agreement of the importance of telecommunications and management of the information resource. The span of topics mentioned is quite broad, but some consistent themes emerge.

TABLE 5

SIGNIFICANT INTERNATIONAL TOPICS BY GROUP

Survey 1 (1990)	Leaders	Accredited	Non-accredited
Worldwid tele-communications	International tele-communications	Global tele-communications	Global tele-communications
Transnational information flows	Transborder data flows	Global strategic use of IT	Transborder data flows
Global strategic use of IT	Global communications - Internet	International standards	Legal considerations (trade & tariff laws; security & privacy)
Multilingual computing	Global enterprise networking	Multi-cultural aspects of IS development	International standards
ISDN	EDI	International law	Understanding cultural differences

This list is consistent with the themes defined by Deans & Loch (1996). In fact, there seems to be considerable agreement across groups in how we might envision the international IS component for curriculum design.

Theme 1: Global Connectivity and Telecommunication

Theme 2: Management of Global Information Flows

Theme 3: Planning and Strategic Implications of Global IT

Theme 4: Global Integration of Systems, Technology, Processes, and People.

When asked to indicate the importance of the reasons for internationalizing the IS curriculum, the results are consistent with the general topics and themes identified for all groups (see Tables 4 and 5). Global economic interdependence and transborder data flows were two of the top three reasons for all three groups. These reasons were considered significantly more important in 1994 than in 1990 where these two items were ranked 4th and 5th respectively. That said, all groups held the same five reasons as top motivators to internationalize the IS curriculum albeit in different order. At the same time, the importance attributed to the various reasons increased comparably over the original survey's assessment. The #1 reason was different for each of the three current groups. The bold numbers in Table 5 signal those reasons where there is a significant difference between the groups at the .04 level with the exception of global economic interdependence at the .10 level. There was no significant differences between the leaders and the accredited or the leaders and the non-accredited institutions.

Reasons for internationalization which remained the same or decreased in importance over the past five years held true for all three groups. The reasons with asterisk found all three groups moving towards internationalization.

Three additional items merit comment when comparing the three groups. First, the non-accredited group found the issue of *faculty with foreign experience and education* to be significantly less important than did the accredited group (p=.04). All groups concurred on the importance of industry demands as a motivator to internationalize the IS curriculum, indicating a similar increase above the 1990 study. Finally, internationalizing the IS curriculum in response to academic governing bodies confirmed an intuitive expectation: the non-accredited group saw their influence of little

TABLE 5

REASONS FOR INTERNATIONALIZING THE IS CURRICULUM

Reason (mean scores)	**Survey 1 (1990)**	**Leaders**	**Accredited**	**Non-accredited**
Growth in multinational corps.	5.48	5.50	5.61	5.74
Global economic interdependence	**5.40** (.10)	**5.75**	5.89	5.80
Transnational information flows	**5.39** (.04)	**5.83**	5.83	5.84
Use IT for international comp. adv*	5.50	5.70	5.73	5.83
Expand global telecommunications*	5.53	5.80	5.72	5.95
Hardware standardization	4.15	4.05	4.05	4.0
Software standardization	4.14	4.15	4.05	4.22
IS methods standardization	3.98	3.86	3.85	3.91
Changes in international law	4.00	4.00	4.05	3.89
Faculty w/ foreign exp. & educ.	3.77	3.48	**3.90** (.04)	**3.27**
Influence of acad governing bodies*	3.56	3.66	3.70	3.37
Industry demands *	4.56	4.95	5.08	4.96

1=not at all important / 7=extremely important / *=moving in a positive international direction
Responses in bold are statistically significant.

import. While both the leaders and accredited groups indicated that it was of more importance than it were to the first survey or the non-accredited respondents, it was the least important reason overall for all groups to pursue the internationalization of the curriculum.

Course Delivery Strategies

The respondents were asked to evaluate the effectiveness of the three most common course delivery strategies on a Likert-like scale at the graduate and undergraduate levels (1=very effective; 7=very ineffective). There is a consistent pattern amongst the groups: all indicated that the most effective means of course delivery was to integrate international topics into core IS course offerings as evidenced by the responses shown in Table 6. The trend, however, is that strategy one, at both levels, is viewed as becoming less effective than previously evaluated by Survey 1 respondents. There is disparity between the groups for strategy two. The leaders and non-accredited groups evaluate strategy two as more effective for undergraduates and less effective for graduates in comparison to five years ago. However, the accredited group's interpretation is exactly the inverse. To further complicate the picture, all agreed that the separate international course alternative was the least effective based on raw numbers but the one category where all groups viewed it as a significantly more effective strategy at both levels five years later.

We can offer several plausible interpretations to the findings. In 1990, offering international topics integrated into core IS course offerings was considered to be the most effective medium of delivery. This may have been for three reasons: a way to offer the broadest exposure to the greatest number of students -- all students must take core courses, and the level of difficulty in delivering the course material was considerably less than for a separate international course. Hence the preferred choice. Another possible explanation is that by integrating international topics into core IS course offerings, the students obtain the most realistic snapshot of what they will find in industry. As schools joined the internationalization effort, they simply did what the first generation leaders did. Five years hence, we have matured in our understanding of what constitutes international information systems, there are more materials available, and we now find that a smattering of international in

TABLE 6

EVALUATION OF TEACHING ALTERNATIVES

Effectiveness (mean scores) 1=very effective 7=very ineffective	**Survey 1 (1990)**	**Leaders**	**Accredited**	**Non-accredited**
Int'l topics incorporated only in select IS courses				
UG	3.47	3.72	3.78	3.72
G	3.39	3.71	3.38	3.75
Int'l topics integrated into core IS course offerings				
UG	3.23	3.06	3.32	3.11
G	2.93	3.05	2.82	3.33
Separate International Course				
UG	**5.18** (.10)	**4.71**	4.66	4.57
G	**4.87** (.01)	**4.08**	4.05	4.21

Responses in bold are statistically significant.

TABLE 7

INTERNATIONALIZATION PERSPECTIVE FOR IS CURRICULUM

Internationalizing the IS Curriculum (mean scores) 1=strongly agree 7=strongly disagree	**Survey 1 1990**	**Leaders**	**Accredited**	**Non-accredited**
IS courses should be taught from a ____ perspective:				
Global *	3.13	3.02	3.12	3.24
US	4.00	4.22	4.52	4.26
Local/regional	4.81	5.07	5.20	4.83
Institutions will offer intl IS course within 3 years *	5.14	4.83	4.49	5.02
IS programs become similar to foreign IS programs in near future *	4.65	4.53	4.47	4.56
IS program *MUST* be international *	3.44	**3.38** (.05)	**2.85**	**3.40** (.06)
Your IS program *IS* international	**4.79**	**4.21** (.02)	4.18	4.62
There is an emphasis on '*internationalization*'	**2.30**	**3.34** (.000)	**3.09**	**3.68** (.05)

Responses in bold are statistically significant.

a core course is insufficient treatment of the subject matter, ergo an increasing preference for the separate course.

Table 6 presents the means by group for each teaching strategy. There were no statistically significant differences found between leaders, accredited, and non-accredited groups. Offering a separate international course remains to be viewed as the least effective alternative although it is significantly more effective than reported in the first survey. As an alternative, a separate international course seems to be most viable at the graduate level in accredited programs. This finding might also reflect the international experience and training, or lack thereof, of faculty. Recall that of the three groups, the accredited group represented the smallest proportion of schools with faculty with no experience or training in international (see Table 3). Stand-alone courses necessitate an instructor who is more conversant in international IS issues than do the other alternatives. This makes it an alternative that is more difficult to replicate widely at all institutions.

IS Curriculum International Trends

Respondents were asked to indicate their level of agreement or disagreement with eight statements (1=strongly agree, 7=strongly disagree). The stronger their agreement with the statements, the stronger their support for internationalizing the curriculum. They first reacted to several statements reflecting the orientation and perspective from which international IT courses should be taught, i.e., a global, U.S., or local/regional perspective. As shown in Table 7, the leaders group is the biggest advocate of teaching courses from a global perspective. There is general agreement amongst all groups that teaching from a local / regional perspective is no longer acceptable. However the non-accredited group expressed their view less strongly. The likelihood of offering an international course within the next three years is not overwhelming although higher than five years ago. The accredited group is the best candidate to do so, followed by the leaders group and the non-accredited group respectively. We acknowledge that stand-alone courses are not for everyone. In addition to faculty interest and expertise, other factors likely to contribute to this finding include resource constraints and administrative obstacles.

The accredited group indicated strongly that the IS program MUST be internationalized. The leaders group and non-accredited group were very similar in their assessment of the directive. Both groups were statistically significantly different from the accredited group. When asked to assess the international status of their own IS programs, all three groups indicated that progress is being in comparison to five years, but slowly. The accredited group self-evaluated the most internationalized. A surprise finding was the reduced emphasis on internationalization perceived by the respondents in the second survey. The differences found were between the first survey participants and the leaders group, and between the accredited and non-accredited groups. There was no significant differences between the leaders group and the accredited or non-accredited group. This surprise finding may actually be positive in that the respondents' level of sensitivity to international is heightened over time such that they are not satisfied with where they are in contrast to where they want to be, where they think they should be, in the internationalization process. That said, clearly the non-accredited group is the least concerned about internationalization viz-a-viz the other groups.

CONCLUSIONS/FUTURE RESEARCH

In summary, the major forces driving IS curriculum reform to include an international dimension are very similar across groups and over time. What has changed is the order of import by group. Both the original study and the non-accredited group ranked global telecommunications and the number one reason. It is interesting to note that those reasons ranked higher by the leaders group and the accredited group are in fact, one might argue, a by-product of global telecommunications capabilities, i.e. *transnational information flows* and *global economic interdependence*.

We can extrapolate from the findings the effects of external agencies, such as AACSB on the internationalization process. When compared to all the other motivating factors to internationalize, *the influence of academic governing bodies* was ranked last. Despite the low ranking, the importance of the factor over time did increase. Moreover, the accredited group rated it the highest of all the groups, which argues that the AACSB directives, for example, are having some influence. The leaders group rated it second with the non-accredited group viewing such entities as being rather unimportant. As the leaders group is comprised of a mix of accredited and non-accredited schools, the result fits the pattern.

When considering different strategies for course delivery, the general consensus seems to be that international topics, whether in select IS courses or in core IS courses, are more effective than a separate international course. The irony is that the ratings over time of each strategy is going in the wrong direction. With two exceptions, that being the accredited group's ratings of graduate level courses, all ratings suggest that we are becoming less effective. In contrast, while the groups ranked the separate international course last in terms of effectiveness, over time, they rated its effectiveness as improving. We offered some explanations as to why this might be in our earlier discussion.

Between one-fifth (accredited group) and one-third (non-accredited group) of the schools indicated that they had faculty with no international experience or training. How then are we to serve the business community? To what extent are we able to ameliorate our condition by producing new faculty members with a strong international component? It would seem as well that there is a small but significant proportion of our schools which have made no attempts, or reported success in the endeavor to internationalize. Almost one-fourth of both the non-accredited and accredited institutions stated that their programs were ***zero*** internationalized. The challenge continues.

If one asks the question, are we making progress? The answer is YES . . . slowly. As we set out to compare the leaders group to the accredited vs. non-accredited groups, we were surprised by the results. In sum, we expected the leaders to out perform the other groups. In reality, we found that membership in the leaders group is by virtue of their participation in the original study, not where they are today in the internationalization of their IS curriculum. Rather, the accredited group showed consistently more advanced in the internationalization process although not of a statistically significance. However, in one instance there was a statistically significant difference between the accredited and leader groups. This one point is interesting as it was in response to the statement "IS programs must be internationalized." The accredited group agreed strongly with this statement (2.85) versus the leaders group (3.38) (p.=.05). Nor was the non-accredited group as committed to this directive (3.40). We certainly expected the leaders group to support this statement.

This study not only contributes to the IS curriculum literature, but it also differentiates between types of institutions and their respective responses to the trend toward internationalization of the IS curriculum over time. A major contribution of this study is that it serves as a base-line for future studies that follow our progress to internationalize the curriculum. We must ask 'Where to from here?' Future examination of our progress in internationalizing our IS curriculum should include consideration of technologies such as the web, and distance learning. We can argue that these technologies transform the development and delivery of courses with international content, making it more accessible to a broader range of faculty groups. Finally, our challenge is to stay in tune with the overall business school curriculum strategy and relevant developments in industry. Here's to the future.

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TAKING THE SHOW ON THE ROAD: THE MULTIPLE REWARDS OF TEACHING INFORMATION SYSTEMS ABROAD

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This paper discusses the multiple rewards of teaching information systems (IS) abroad, drawing on the experience of an IS professor who has been awarded three Fulbright scholarships in the 1990s. The author draws extensively upon personal experiences in Russia to illustrate the challenges and benefits of teaching in foreign institutions. The impact of the experience is discussed in these areas: course content, curriculum development, economic development, research, and professional development.

The opportunities and incentives to teach information systems abroad have increased significantly in the 1990s, particularly in emerging economies, where the need for IS faculty is critical. Although information systems (IS) have "gone global" in practice, few positions are reserved for IS faculty in prestigious educational and research exchange programs, in contrast with fields such as economics, business administration, and marketing. Often IS faculty must locate programs and host institutions, and solicit and submit invitations to teach to grantors such as the USIA. The need for IS faculty, particularly in emerging economies, is critical. Continuous re-examination of scope and mission is symptomatic of a healthy, vibrant discipline. Work in societies which are self-consciously engaged in historic geopolitical and socio-economic transition offers irreplaceable experience for insights and creative solutions which are impossible at arms length. A list of research subjects is included to illustrate the panoply of resources available for IS practitioners and educators who "take the show on the road".

THE GLOBALIZATION OF EDUCATION

In the 1990s, opportunities and incentives to work abroad increased significantly for IS practitioners and educators. Information-rich and communication-intensive services such as insurance accounting, medicine, law, security, publishing, financial services, management consulting, software programming, and advertising became internationalized. By 1997, IT-enabled global services comprised almost a third of United States exports, and the quantity and the value of exported services continues to increase annually. By 1997, IT-enabled global services comprised almost a third of United States exports, and the quantity and the value of exported services is accelerating and irreversible.

Seminal improvements in information technology (IT) and communications facilitated the maturation of the global market and the implementation of progressive business strategies, and simultaneously stimulated seismic geopolitical and infrastructure changes in emerging markets, especially in Eastern Europe. As a result, in the last half of the decade, a broad variety of white collar professionals work routinely with global business partners, regulators, and customers throughout the wired world.

The globalization of education followed and mirrored the internationalization of IS and business services. Universities have been followers, not leaders, in both globalization and also business reengineering. In the intense competition for applicants in the past twenty years, schools of higher learning have reinvented themselves, progressing from contained space, to universities without walls, to universities across borders. The search for new pools of applicants, American students' demands for study abroad and for intensive language training, the enhanced prestige gained through international partnerships, and the demonstration effect of lucrative global alliances created both a need and a willingness to serve students both at home and abroad through faculty exchanges. Colleges or faculty who avoid the new arena face critical experiential, intellectual, and financial disadvantages.

The pressure on colleges and universities to open new markets can lead to a sea-change in academic life, an intellectual as well as a physical movement toward integrated, extended, and open institutions which facilitate not only cost-effective synergy but also quality improvements. Perhaps more than any discipline in the university, the quality of the IS curriculum depends on a global focus. The integration of communications and computer technology which spawned ubiquitous software houses, consulting services, and multinational management both enables and requires IS researchers and educators to "take the show on the road".

Educators who live and work in varied international settings, gain an expanded appreciation of IS in the new millennium through fresh cultural and economic perspectives, and can incorporate current global issues in research and in class with alacrity. For the IS educator, the movement abroad offers at least nine areas of opportunity:

1. multidisciplinary research and teaching;
2. exposure in the field to novel socioeconomic issues;
3. a fresh view of changing business needs and ranges of appropriate solutions;
4. the impact of varied value systems upon IS ethics;
5. acquaintance with a variety of IT infrastructures;
6. invaluable contacts and partnerships;
7. the exchange of student ideas and projects at home and abroad;
8. a position from which to anticipate and evaluate future global changes, with an area of specific global expertise;
9. time and a new space in which to listen and observe, to indulge in the role of witness and in travels of the mind.

IS teaching and research abroad requires not only multidisciplinary approaches, but also an ongoing evaluation of the parameters of IS as a field of study. For example, an ongoing examination of the confluence of factors which create strategic advantage in various global settings calls for an ongoing evaluation of purpose and method: "Are we asking the right questions?" "What is changing?" "What insights and tools can we borrow or supplement here?" This re-examination of scope and mission of IS ensures a healthy, vibrant field of study. Work in societies which are self-consciously engaged in historic socio-economic transitions offers not only insight into IS, but also life experiences which are impossible at arms length.

Four sections of this paper, drawing on experiences in Russia, and also Morocco to a lesser degree, illustrate some specific challenges and benefits of work abroad in these areas: course content, curriculum development, economic development, and research and professional development.

APPOINTMENTS ABROAD: A CHANGING PATTERN

Like other exportable United States-based services, education has become a "hot" global commodity. Educational services are exchanged in three ways: electronically through distance education, by the importation of foreign students, or by the exportation or exchange of faculty. American business education is especially salable, but the dominant paths for faculty to secure a foreign position have shifted in recent years. In the 1990s exchange programs, corporate grants, multiple campuses abroad, and marketing programs aimed at Internationals have increased. In contrast, grants and fellowships through non-profit private organizations and government agencies may be in permanent decline.

With the collapse of communism in the West and federal budget constraints, cuts in the United States Information Agency budget have reduced by approximately 25 per cent the number of Fulbright senior fellows sent abroad in the past three years. Also, in 1997, responsibility for the senior scholar program was been transferred to the Council for the International Exchange of Scholars, and numerous changes in the Fulbright program, especially shorter awards, are being contemplated. Although information systems (IS) have "gone global" in practice, few positions are reserved for IS faculty in prestigious educational and research exchange programs, in contrast with fields such as economics, business administration, and marketing.

However, the growth of the Internet and collaborative partnerships create innumerable opportunities for IS faculty who want to teach abroad. This is particularly true of institutional alliances, often involving multiparty arrangements between schools in the United States, Western and Eastern Europe, China, and the Pacific Rim. Within Russia, for example, Ohio State has a relationship with the University of Tomsk, the University of Maryland engages in faculty and student exchanges with the University of Irkutsk, and the University of Alaska has an arrangement with Vladivostok. Interested faculty may ask numerous United States-based universities about vacant positions abroad which the sponsoring institution is generally eager to fill. Resource reference books such as Deans' and Loch's Thunderbird Guide, assist educators to locate host institutions and programs, to propose a foreign appointment directly or through third parties. When a bilateral agreement is not already in place, however, faculty must convince their administration to grant leaves of absence and possibly financial support.

TEACHING ABROAD

In developing economies and in the emerging economies of Eastern Europe, IS faculty are commonly invited to teach within Departments of Economics. Indeed administrators and faculty may not know what IS is, and often ask for catalogue descriptions and syllabi. Within the first and second tier of universities, Schools of Business are uncommon; within polytechnic institutions and trade schools, informatics and computer science are established fields of specialization, but students in these departments typically lack the barest acquaintance with business applications except for a limited exposure to labor management. Across the spectrum of diverse educational systems, the key learning and teaching challenge is to position IS within a broad context of changing business needs and resources. IS educators are expected to present not only cases and dominant trends in United States business practice, but also understand "local" information needs and IS solutions. IS educators who focus on business information needs often introduce the host institution to an understanding of IS for the first time, and visiting professors can be enormously helpful in the foundation of an IS curriculum. In addition, IS cases and videos set in different economic systems have the bonus effect of teaching the importance of quality, cooperation, and competitiveness in successful organizations.

Although Eastern European institutions often accept English-speaking in the second half of the 1990s, the problem of language may arise there and elsewhere. The author taught both international business and IS in a variety of institutions in Russia and Morocco: all business courses were presented in French in Morocco, most lectures in Russia could be delivered in English, or in a combination of Russian and English with the help of a translator. However, research and networking would have been severely constricted without fluency in Russian.

It was a privilege to define "local" information needs and to identify the most important questions in finance, accounting, or marketing for colleagues and students in nascent market economies. IS educators who focus on business information needs often introduce the host institution to an understanding of IS for the first time, and visiting professors can be enormously helpful in the foundation of an IS curriculum and lasting relationships. In addition, IS cases and videos set in different economic systems have the bonus effect of teaching the importance of quality, cooperation, and competitiveness for successful organizations.

COURSE CONTENT AND METHODS IN THE KUZBASS

In 1994, the author taught an introductory course and three seminars in IS, including two seminars for faculty with a focus on business education, at Kemerovo State University, Kemerovo Polytechnic University, Tomsk University, and the Institute for Automatic Control (GUARETS) in Tomsk. In addition, three courses and a seminar in international business with an emphasis on international IS were offered in Kemerovo, at the State University and the Polytechnic; curriculum development materials and textbooks for a major in Is were acquired through a USIA grant and delivered to institutions in Kemerovo, Tomsk, Moscow, and Irkutsk. The author also wrote an article on feminism for a regional newspaper, and delivered presentations to the managers of Kuzbass Associates, an major exporting group from Western Siberia.

Academics were deeply and visibly impressed by the quality of IS textbooks, transparencies, and videos. In 1992 and 1993, the author's American students were asked to provide superior overheads with their MIS, systems analysis and design, and database management projects, and informed that the best of their projects would be used for teaching Russians in 1994. Russian students and faculty were deeply impressed by the range and quality of these independent projects. Some projects focused on activities such as inventory management, electronic music, transaction processing, security, or E-Mail using enterprises such as Toys R Us, a Broadway show (Miss Saigon), Harry's Liquor Store, Federal Express, and Sikorsky Aircraft. Other American students investigated broader topics: the information highway, desktop publishing, multimedia. Students' names were included on the overheads, and Russians often asked for personal information about the authors.

Projects and industry videos were extremely effective vehicles: seeing, rather than listening, improved learning and the credibility of the curriculum was enhanced through project walk-throughs and films made in the context of a modern business environment. IS educators who focus on business information needs often introduce the host institution to an understanding of IS for the first time, and visiting professors can be enormously helpful in the foundation of an IS curriculum. In addition, IS cases and videos set in different economic systems have the bonus effect of teaching the importance of quality, cooperation, and competitiveness in successful organizations. Questions from faculty often centered on the issue of quality and competition within the university. To an American accustomed to relatively tame and gentile faculty meetings and committees, the shouting and heated discussions not only about teaching theory and technique, but also about topics such as tenure, teaching loads in the West, consulting activities, student evaluations, and textbook prices were memorable.

No topic was more difficult to approach than the issue of ethics in academic and business and information systems. The author visited dozens of computing facilities and university laboratories, and seldom saw any microcomputer software that did not appear to be pirated. Faculty and students frankly inquired about the potential to accelerate economic development by computer piracy, illicit access to proprietary information, on-line financial chicanery, and other breaches of ethics.

Most Russians appeared not to believe that ethics and success are compatible; the author believed that Russian hosts politely tolerated discussions of ethics but simply did not believe ethics were significant at home or abroad.

In contrast, the author received an Inter-Country Fulbright to Morocco in the fall of 1994, and taught quality management and information systems in Rabat, at Mohammed V. University in the Faculty of Law and Economic and Social Sciences, and in Casablanca, at the Institute des Etudes de Commerce et d'Administration d'Enterprise. Interest in ethical issues and an appreciation for product quality and customer satisfaction was markedly greater in Morocco than in Russia. Also, university tradition and governance were similar in Morocco to the United States, and topics such as rank and tenure were not raised. The author was surprised that in both countries, teaching loads were quite modest and office hours were rarely required.

CURRICULUM DEVELOPMENT IN TAGANROG

The author has been invited to teach for a semester and to assist in curriculum development in both Information Systems and International Business at Taganrog State University. From 1994 to 1997, E-mail discussions with Taganrog faculty and administrators about Taganrog's Economics curriculum began preparations for the lectureship in international business and information systems in the spring of 19998, as well as for research, ongoing relationships, and a method to develop course prototypes for the host institution. The fellowship was an exciting challenge in the ancient city on the Sea of Azov which was founded by Peter the Great and still serves as a window to Black Sea and to the commercial hub of Istanbul.

The author has been in contact with Taganrog since the summer of 1994, when two International Education Exchange students, one from Taganrog, served as research assistants for a Lattanze Center for Executive Information Studies consultantship. The team identified and analyzed data deficits for two dozen United States corporations who were interested in constructing decision support systems for trade and investment in Russia.

In both international business and information systems, information resource management (IRM) is a priority in Taganrog's curriculum, to assist the development of information and business systems which optimize the use of information: to supplement and rationalize the use of labor, capital, material resources, management skills, and partnerships. Entrepreneurs in emerging markets look to IRM for multiple business functions: to reduce waste, to improve product and service quality, to facilitate strategic planning, and to seek foreign aid and partnerships. The host institution at Taganrog is progressive, and has proposed to locate a module in IRM within a new major, "Data Systems in Economics". "Data Systems" is comparable to "Information Systems" in the West. The University seeks to integrate computer science skills, economic models, and new areas such as accounting, financial management, law, and environmental studies. Taganrog needs additional courses and materials which feature concrete examples of business practice, especially in information systems, international marketing, and international management. The Rector also requested that the Fulbright fellow develop a cogent curriculum in international business theory and practice, and assist local firms to become export-oriented.

The most critical problem in international business education in Russia is the pressing need to couple marketing and management education with both IS and also Western economic theory. The discussion of economic theory in addition to IS practice requires cases studies, videos, and other germane materials ranging from the Yellow pages to bank statements. As a result, this project conveys significant research opportunities in the area of theory as well as practice. The most critical components in information systems in Russia are not hardware or software, but people and information itself. Because of cultural differences and a lack of business theory, introductory courses and systems analysis abroad must justify the need for critical intellectual shifts in Russia to develop quality information. Therefore, foreign students are exposed to game theory, the advantages of both competition and cooperation, through cases in information analysis and also through culture-specific exercises which encourage information sharing.

For hundreds of years, predating communism, economic development has been an <u>intellectual</u> problem in Russia. Western education can take for granted numerous accepted precepts, material preconditions, levels of business expertise, and a sense of economic community which do not exist in Russia at this time. Both domestic and external stakeholders must mold IS education to meet host countries' needs.

ECONOMIC DEVELOPMENT AND IS

Effective information systems and international business education in Russia is a priority for Russian policy makers, educators and entrepreneurs. Among the multiple rewards of teaching IS abroad is the chance to play a small role in the historic transition, to augment scarce information resources, to project future business needs, and to improve the information infrastructure. The Russian economy represents a conundrum: information deficits are critical in most industries, yet without a minimal level of market development, information resources cannot be much improved.

Without a critical mass of robust data, computer literate personnel, and skilled knowledge workers, IS's value in the transition to a demand economy is limited at present. Russian managers cannot develop markets, rational internal procedures, business alliances, and, most importantly, improve goods and services without robust information resources. Indeed, not only must Russia seek competitive advantage in the global market through high quality and low cost exports, but also, in the second half of the 1990s, Russia must defend its domestic market against foreign goods. Butter, eggs, chocolate, clothing, sports equipment, canned goods, cookies, ice cream, produce, and cut flowers from Western Europe and the Pacific Rim have flooded stores and kiosks, from Moscow through Siberia to Vladivostok in Asian Russia. Although a surprising number of Russian business enterprises are well-capitalized, even the most elite educational institutions are impoverished. These schools are handicapped and embarrassed not only because of a lack of capital, but also by a dearth of textbooks and other teaching materials, by minimal exposure to mainstream IS scholarship and business applications, and by brain drain, as talented faculty leave teaching for more lucrative work in the emergent market economy. Those faculty who remain often have little or no acquaintance with market forces and occasionally are hostile to business practice.

Taganrog and other progressive institutions of higher learning are seeking to change the curriculum-wide emphasis on supervision and control, to challenge a prejudice against information sharing, and to augment information on personal responsibility and individual entrepreneurship.

Often, a culture-based communication gap separates Western business lecturers and Russian academics. IS educators who focus on business information needs often introduce the host institution to an understanding not only of an IS curriculum, but also business language and concepts. Even though some Western words, such as "marketing" have been imported intact into current Russian conversation, an understanding of the concepts behind business vocabulary will require years of market experimentation and competition. "Marketing", for example is often vilified as deceitful and wasteful promotion: the other four P's of the equation: product, price, and place are not examined adequately. The role of IS in developing quality products and services was frequently challenged as frivolous, as was total quality theory itself. Students were often more receptive to quality methods and theory than faculty, evidence of a generation gap and a communication gap, in information systems and international business pedagogy.

Business education in Russia is young, yet affected by enduring cultural and economic factors. For example, "information poverty" is a widespread condition, the result of an ingrained and widespread reluctance to provide or share information, and also of the meager supply of useful information which was left as a legacy of failed central planning. Materially and economically, other contemporary problems constrain business education and practice: the lack of a satisfactory communications infrastructure, monetary instability, disruptions in supply and distribution, corruption, and changing regulations. Although education reform is a priority, the possibility of substantial investment in an expanded information systems or an international business curriculum often depends on external assistance.

RESEARCH AND PROFESSIONAL DEVELOPMENT

Although numerous academic journals have suspended publication and the periodical section great repositories such as the Lenin library are nearly barren, the scholar enjoys unprecedented opportunities for primary research and other field work. Table 1 illustrates the range of Russian research contacts established from 1991-1995 (Chepaitis in Palvia, Palvia, and Roche, 1996). The author interviewed forty-four Russian and ten foreign entrepreneurs, researchers, and policy makers in five major cities during the summer of 1991, 1992, one semester in 1994, and consulting in 1995. Interviews were rewarding and memorable, with heavy use of popular aphorisms and humorous anecdotes, in the Russian style. Researchers must be nimble in such as dynamic environment: research data shifted dramatically and had to be re-examined and topics had to be redefined over the four-year period. The participants were three questions: their business conditions, their organizations' goals and information needs, and the availability of information resources. Data was often poor quality, inconsistent, or unavailable, but, for Russia, research yielded remarkable and singular "finds". Interesting strategies for dealing with information shortages emerged. For example, YUGANSKNEFTEGAS sent over 1,000 interns abroad into business environments where information is not scarce. A more common strategy, for small enterprises, is to do business with minimal, accurate data and develop modest decision models until conditions and the infrastructure improves. Numerous businesses sought foreign partnerships, "gray economy" sub-businesses, or relationships with middlemen who took benefited from imperfect information and imperfect competition.

Questionnaires are unpopular and unanswered, but interviews were often revealing and unforgettable. A cursory look at the research subjects may suggest the rich quality and intensity of learning and research through work abroad.

DEVELOPING AN INTERNATIONAL FOCUS IN IS COURSES

IS professionals, especially educators, have not yet identified the most important questions in international information systems. One unfortunate consequence is that technical aspects are over-emphasized, and international

TABLE 1

INTERVIEWS WITH RUSSIAN CITIZENS (44)1991-1995

Firm/Occupation	Type	Location	Firm/Occupation	Type	Location
GEMMA telecom director	G	Irkutsk	Kuzbass External Associates, President	G	Kemerovo
Irkutsk State U. Rector, foreign relations	E	Irkutsk	Kuzbass Primapolis, shareholding firm, VP	G	Kemerovo
AG garden tools, management intern	P/S	Kemerovo	Kuzbassobank, chair, board of directors	P/S	Kemerovo
ASM air cargo, management intern	P/S	Kemerovo	The Professional, advertising	P/S	Kemerovo
Chemmash, marketing services, manager	P/S	Kemerovo	PROMEST, import/export, director	P/S	Kemerovo
Deputy Chief, mayor's office	A	Kemerovo	Raspadskaya coal, environmental engineer	C	Kemerovo
Development, Junior Achievement, director	A	Kemerovo	Restaurant manager	P/S	Kemerovo
EC consultant, lumber exports	C	Kemerovo	Tapes, audio supplies, manager	P/S	Kemerovo
Fedorev regional library, operations	A	Kemerovo	Siemens sales manager	P/S	Kemerovo
Fedorev regional library, acquisitions	A	Kemerovo	Ziminka coal, tools development, manager	G	Kemerovo
GARANT insurance	P/S	Kemerovo	Sigma, Russo-Japanese consultant/manager	G	Krasnoyarsk
Georgian greengrocer	P/S	Kemerovo	Moscow Central Stock Exchange, Vice President	P/S	Moscow
FATA joint venture, industrial tools, sales	G	Kemerovo	Moskva bookstore, sales	P/S	Moscow
Hospital intern/physician	P/S	Kemerovo	Produce farm, privatized sovkhoz, director	P/S	Moscow
Informatics, software development	P/S	Kemerovo	Distance education, project director	E	Tomsk
Intourist travel, manager	A	Kemerovo	Dom. small hotel owner	P/S	Tomsk
Kemerovo airport, management intern	A	Kemerovo	Tomsk radio systems, IS developer	E	Tomsk
Kemerovo city ambulance dispatcher/manager	E	Kemerovo	Tomsk State U.-Russian-Am. exchange, dir.	E	Tomsk
Kemerovo State University, vice rector	E	Kemerovo	Siberian Adult Education Academy, dir.	E	Tomsk
Kemerovo Polytechnic U., Dean of Economics	E	Kemerovo	YUGANSKNEFTGAS, oil and gas, management intern	G	Tyumen
Knigi bookstore, manager/buyer	P/S	Kemerovo	Kouchat fried chicken rest., manager	P/S	Vladimir
KROMBANK, deputy manager	P/S	Kemerovo			

KEY
A= Public Admin. P/S= goods/services E= Education C= Consulting G= Global partners
(Chepaitis, in Palvia, Palvia, and Roche)

information systems is occasionally taught as an applied telecommunications course. In numerous surveys, corporate leaders criticize information systems education for its overemphasis of technology, such as hardware and programming, and for the neglect of basic business knowledge and skills (Wiersba). Ongoing global research and academic experiences abroad enrich current resources substantially, especially if IS travelers utilize expertise in related disciplines, such as economics, language, or international marketing. Hopefully, increased numbers of IS academics abroad working may augment the quantity and quality of international case studies, teaching modules, textbooks, and IS theory.

CONCLUSION

The synergy achieved through teaching serially at home and abroad is significant and unique. The leading challenges and constraints--cultural, linguistic, infrastructure, pedagogical, and organizational--are in themselves instructive. "Taking the show on the road" immerses IS educators in unexpected scenarios, into cultures where resource endowments and scarcities impact global IS deeply.

Teaching and learning abroad, creates a healthy and necessary appetite for work and learning in varied cultural, economic, and political settings which invigorates IS education, practice, and research.

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DISTANCE TEACHING A GRADUATE COURSE ON INFORMATION SYSTEMS ANALYSIS AND DESIGN

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A graduate distance course on Information Systems Analysis and Design was designed and delivered under the guidance of the following four philosophies: (1) an effective education is a learner-centered education; (2) distance students are more likely to experience situated learning and problem-based learning; (3) enforced learning should enable distance learners to achieve higher learning performance and satisfaction; and (4) the driving force behind a distance course is the effective learning of subject topics, not the enforcement of state-of-the-art distance education technologies. The course was well presented and received. Students reported a very satisfactory learning experience. This paper describes in detail the course planning, actual delivery, learning results, and technology use. Different distance course models are also introduced. Experiences, lessons learned, and practical suggestions can help other distance instructors to deliver effective distance education. The author concludes with a discussion of several important distance education issues.

INTRODUCTION

Distance education is a process to create and provide access to learning when the source of information and the learners are separated by time and distance (http://www.reeusda.gov...). Distance education has become increasingly common in recent years as distance education technologies expand at an extremely rapid rate. Distance education has also become an important part of higher education all over the world. There are, however, many challenges and uncertainties that distance instructors need to face in order to effectively deliver all types of distance courses. Unfortunately, not many reports on successful delivery of distance courses can be found. Thus many distance instructors have to struggle and try things by themselves.

In this paper, we discuss our experience and the lessons learned during the design and delivery of a graduate distance course on Information Systems Analysis and Design (SA&D). Several aspects of the report make it valuable to a variety of audiences. First of all, we discuss four important philosophies that are pertinent to distance education. Some researchers have identified some of the philosophies, such as learner-centered education (Sherry 1996), situated learning (Streibel 1991), and the observation that technology should not be the driving force of distance courses (Sherry 1996). However, the philosophies have not been widely incorporated into distance instructional designs. It is also unknown whether these philosophies ensure successful course delivery. Second, the subject matter of the course, Information Systems Analysis and Design, is rather cognitively challenging to teach and learn. The course requests students to build skills to succeed rather than just to acquire information or knowledge, and this is challenging even in a traditional teaching and learning mode. As distance education grows, more challenging courses will have to be delivered in a distance format. Experience and lessons learned in this course can definitely help other distance instructors to avoid pitfalls and be more effective. Third, the paper describes methods of collecting useful information on students' background and learning. The instruments can be used widely in many kinds of courses, traditional or distant.

Forth, the paper introduces several models of distance courses at Syracuse University. This can be valuable for distance education directors who need to plan and design distance course models. Fifth, the author discusses several important distance education issues in light of distance teaching practice, including distance teaching workload distribution, the role of distance instructors, and class policies. To limit the length of this paper, statistics of actual technology use in distance learning are described in a different paper (Zhang 1997) in order to fill a gap. There are many suggestions about how to use the available technologies in distance education, but few usage data are collected and analyzed to provide insight into the effectiveness of distance technology.

In the next section, we first state the philosophies that guide the design and delivery of this course. Then we follow an instructional design model (http://www.reeusda.gov...) to describe the design of the course. The design process is by no means a straightforward sequence. There are many iterations and revisions. In this section, we report on major considerations, not the sequence of actions. Section 3 reports the actual delivery of the course, while section 4 is about learning results. In section 5, we draw conclusions and provide suggestions for distance instructors. We then discuss several distance education issues.

COURSE DESIGN

Syracuse University has been offering independent study degree programs in Library Science for many years. In August 1996, Syracuse started offering a distance learning master's degree in Information Resources Management (ISDP-IRM). The 42-credit degree program consists of a selection of courses offered each semester, including summers. Current courses can be in any of the three models. Model A is an intensive summer class. Students reside on campus (thus the course is called a residency course). They meet in classrooms (including labs) eight hours per day for a period of two, five, or seven days for one, two, and three credits respectively. Students finish the course within the residency period, sometimes with additional time given to complete assignments. Model B is offered entirely at a distance via the Internet. Students and the instructor do not see each other at all during the course. Model C has a short period residency (3-4 days) for face-to-face intensive meetings, followed by home study via the Internet during the rest of the course. The SA&D course described in this paper is a Model C course with a four-day residency and four months of home study via the Internet.

During the very first course in this degree program, which was a Model A class in the summer of 1996, this author guest lectured three hours on general aspects of SA&D. Students then spent unexpected three more hours discussing what they would like to learn from this class. The author has taught SA&D to traditional graduate students several times and one Model A distance course. However this guest lecturing experience made the author realize the very different experiences and expectations from the distance students. It was very obvious that the course needed to be completely redesigned to satisfy the distance students' learning objectives. The planning and redesign of the course started immediately following the guest lecture and lasted for about five months.

Philosophies

Four underlying philosophies or beliefs guide the design and delivery of this course. First of all, we believe that in any education, the ultimate goal is effective learning by the learners. Thus an effective education is a learner-centered education. Our course design starts with a thorough analysis of potential students in this class.

Theories in distance education research indicate that distance students tend to experience situated learning and problem based learning (Streibel 1991, Savery & Duffy 1995). Most distance students are motivated and mature adult learners and have working experience. They would prefer to actively construct their own internal representations of knowledge rather than accept what the instructor gives. Thus they would more likely experience situated and problem-based learning. The challenge for distance educators is to set up a cognitively rich learning environment to facilitate the distance students' construction processes.

The third philosophy is that enforced or controlled learning will help distance learners, who play multiple roles in their lives, to achieve higher learning performance and satisfaction. Enforcement includes instructor's control on students' effort on different subject topics in the course (workload, iteration or reinforcement, and integration), on students' involvement in class activities and collaborative learning, and on learning pace (time scheduling). This philosophy implies that the control of learning is not completely by the student. This is disagreeable with the self-controlled-learning approach that some of the current distance education research advocates (Jonassen 1992).

Sherry notes that "too often, instructional designers and curriculum developers have become enamored of the latest technologies without dealing with the underlying issues of learner characteristics and needs, the influence of media upon the instructional process, equity of access to interactive delivery systems, and the new roles of teacher, site facilitator, and student in the distance learning process." (Sherry 1996) We agree with Sherry and believe that the driving force of a distance course is the effective learning of subject topics, not the enforcement of state-of-the-art distance technologies.

Learner Analysis

Besides some known features of distance learning students, such as maturity and motivation, we focus on more specific features of the potential students for this class. We started with analyzing all ISDP-IRM students in the degree program. Using the information students provided in their directory and to the very first class they took, profiles were constructed on the basis of their technical proficiency (production software applications, operating systems, Internet facilities), working experience (the kind of work they did and do, responsibilities at work), future career plans if any, and other comments on the degree program.

According to the profiles, most students had no work experience with SA&D. Few of them had knowledge about SA&D, although quite a few of them thought they knew a lot about SA&D. Most of them were not interested in being analysts in their future, nor system builders. However, they were interested in the relationships between SA&D and other organizational issues, the trend of system development, and different role analysts might play.

A tentative course syllabus was constructed based on this analysis and was published on the class web site. A more in-depth learner analysis took place after students registered for the class but before the class began. This in-depth analysis consists of three major components: learner background, learner needs or expectations for this class, and learner self-assessment on the subject topics. Sixteen registered students were asked to fill up a questionnaire. Fifteen answered questionnaires were collected and analyzed.[1] Appendix A is a copy of the pre-questionnaire.

Part A of the pre-questionnaire collects students' educational background, Information Systems related experiences, and their motivation for taking this class. The students have a diverse educational background, evenly distributed among the four types. Nine of the students had no experience in SA&D, three had more than eight years, and three had less than four years. Four students had never been users of an IS or involved in management of IS projects or personnel. Five students took a similar SA&D course years ago (from three to fifteen). Two students had absolutely no team work experience, seven had more than ten years, and rest had from one to four years. The top two reasons for taking this class were summarized as (e) gain knowledge, skills, experience, and (a) degree required/advised to take.

Part B is a measure of students' perceived learning objectives. The results show that the students' learning objectives come almost equally from their own (12 selections on item B1) and the course syllabus (10 selections). Thirteen out of 15 students felt that their learning objectives were consistent with those specified in the syllabus. One student selected "identical," while one student selected "conflict."[2]

In Part C, students were asked to assess their own SA&D expertise or competency before they took the class. Two students seemed to have some expertise on most topics, while the majority had little competency. Table 1 lists the class wide average of the answers to the competency questions (before class). These answers were used as a reference of students' current competency. Thus the depth, pace, and coverage of the course can be determined.

The author also collected information on students' distance learning experience from the degree program director. Before the SA&D class, 11 out of 15 students took a web design course, 14 took at least one Model A course, 11 took at least one Model B course, and two took one Model C course. Only one student had not taken any distance course.[3]

As the majority of the students had some distance learning experience, they were asked to predict the effectiveness of teaching techniques or methods on three components of the SA&D course: knowledge, skills, and perspectives. This also familiarizes students with potential techniques to be used in the class and potential topics to be covered in the class. Appendix A Part D[4] is the Predicted Effectiveness of Teaching Technique. The collected data helped the instructor to select particular instructional methods for different course components. The course syllabus and other course materials were finalized based on this second part of the learner analysis.

Learner-Centered Objectives and Course Content

SA&D is a complex, challenging, and stimulating organizational process that a team of business and system professionals uses to develop and maintain computer-based information systems (Hoffer et al. 1996). In today's world where information systems are an inseparable part of an organization, SA&D is an expertise that every Information Technology professional should have. With the rapid development of CASE tools, 4GL database management systems, and GUI, the focus of SA&D shifts from technological constraints to problem-oriented constraints. Often the major constraint on our ability to build effective systems becomes our inability to understand the full scope of the problem. (Fertuck 1995)

SA&D is often difficult to teach and students often find it very difficult to succeed. Students either do not have a real world experience of organizational needs for information systems, or do not have the technical background for making sense of the back end of the system development life cycle (SDLC). Thus they cannot fully understand the entire SDLC process. The modeling methods covered by most SA&D courses are cognitively challenging. Training students to think precisely in different ways than those they are accustomed to is difficult; making them realize that mastering the complexity of a system during the analysis is quite an exhaustive task is not easy either. Students often realize that the course requires them to actually build their analytical skills, communication and collaboration skills, and managerial skills in order to succeed the course.

In this class, we began by considering the current technology trend (more software outsourcing and buying from the shelves, less in-house development), the importance of knowing the front end to the understanding of the entire field, along with most students' background, interest and future career plans. We then decide to cover most aspects of SA&D but focus on the front end of the SDLC process. This focus includes the emphasis on soft skills (oral and written presentation skills, time management, and the ability to interact with peers), which are highly regarded by current IT employers (Computer World 1997). The course objectives are: (1) To comprehend SDLC process and different software development methodologies; (2) To build analytical skills by studying and applying system analysis techniques (Entity Relationship modeling, Data Flow modeling, and Object Oriented analysis); and (3) To understand managerial issues and special challenges involved in SA&D. Several items from Part C of the pre-questionnaire were dropped from the main coverage of the course and became optional self-study topics, which could be used as students' term paper subjects. These items are C2 (organizational activity modeling), C6 (logic modeling), C7 (data normalization & definition), and C11 (CASE tools). The system boundary and specification item (C21) are highlighted in the class to reflect the main focus on the front end of SDLC.

These course objectives are accompanied by three learning themes: (1). Experiential learning through assignments and projects; (2). Collaborative learning the important concepts and techniques with peers through project conduction; and (3). Learning more from each other through project evaluations.

To utilize students' situated learning and problem based learning, to motivate students' learning and application of SA&D to the real world, and to enforce the students' integration of separate course topics, one of the major aspects of the course is a requirement for students to identify, initiate, specify, and analyze real world projects. Each student is to play different key roles in SA&D in order to learn different perspectives. Thus each of them has to be both the customer (user) of a project and the analyst of another project. A customer of a project identifies a real world project topic, initiates a project proposal, and then assists the analyst to finish the analysis by providing details and evaluating the deliverables. An analyst analyzes the proposed project, provides representations of the project using the techniques introduced in class, gets approval from the customer for each deliverable, and revises analysis results based on feedback from the customer. Both the customer and the analyst are responsible for the entire project. Specifically, a customer is solely responsible for the proposal. The responsibility distribution for the analysis is 20% by customer and 80% by the analyst. A very important document for the project is the so-called Interaction Worksheet, where each party of a project records all the project related interactions he or she has with either the instructor, the TA, or the other party, the means of communication and the length or duration, the topics, and the major decisions made. Their effort and performance are assessed by selected peers, the instructor, and the TA. This implies that each student also has a chance to be an evaluator of students' projects and thereby to learn from others in the class.

Using real world projects increases both challenges and workload for the instructor and the TA. In order for the instructor and the TA to be able to comment on each of the projects individually, they must be able to grasp the important features of the project or the field and analyze the project to certain extent.

Students are to be evaluated by (1) their performance on several individual assignments (position paper, term paper, modeling techniques, and project review) and (2) collaborative effort and performance that are reflected in their project reports.

Instructional Methods and Strategies

Since this SA&D course has actually three different periods (pre-residency, a four-day residency, and a remote home study period), different strategies are used for each period. For pre-residency, students need to warm themselves up for the course from both concept level (subject content) and practical level (a real world project). During the intensive meeting, the emphases are on the overall picture of the field, the understanding of three modeling methods, and the initiation of team projects. For the home study period, individual assistance via available technologies becomes the primary concern. The goal is to ensure that students can get timely assistance and feedback, can finish individual assignments on time with decent quality, and most importantly can finish the team projects.

Before the residency, students are asked to skim the textbooks to familiarize themselves with the subject topics and find their weaknesses. As a result, students are to write a position paper on the roles of a system analyst in the system life cycle. They are also to identify a real-world information system project that is to be analyzed by a classmate. Students must have a certain amount of SA&D knowledge in order to find an IS project. They have a chance to get feedback from the instructor on the nature and scope of their projects before they come to campus. A formal project proposal has to be submitted by each student on the first day of class. Since the student is the customer of the project, he or she must "sell" the project to someone, so that on the third day, a contract with signatures from both the customer and the analyst can be submitted to the instructor.

During the four-day residency period, the major delivery method is lecture on overview of the fields and many related issues, followed by extensive in class exercise on the three different modeling methods. A guest lecture provides a different view on the field. Students are advised to use evenings to build project teams, initiate projects, digest lectures, and prepare individual assignments.

During the four-month home study period, students finish three individual assignments on the three modeling methods examined in class (ER, DFD, and OOA). Students arrange their own ways to finish the projects. Their first project reports are to be thoroughly evaluated by the instructor and the TA. Considering the comments, students revise their analyses and prepare the final reports. The final report is a complete package including the original proposal, contract, system requirement specification, three analysis results using the three methods, comments and insight on what was learned as a customer and an analyst, comparison of different analysis methods, and a record of all communications and decisions on projects including customer-analyst interactions and students-instructor interaction. This final report is to be reviewed by other students. By the end of the semester, each student submits a term paper focusing on any interesting issues in SA&D.

The following technologies are set up and supported for the course. Since every student has email access, every member of the class, including the students, the instructor, and the TA, is required to subscribe to the class listserv. The listserv functions as a broadcast facility and class-wide discussion vehicle. The instructor's personal email address, the TA's personal email address, and a class email address are available to the students. Although some email utilities can attach a binary file, which can be used as a way of distributing some course materials or assignments, not everyone uses the same email utility. A class FTP site is thus set up for distributing class materials and collecting students' assignments. The use of FTP is optional. A class web page functions as a map that includes links to class ftp site, all email addresses, and course materials such as syllabus, class handouts, assignments and solutions, course work evaluation summary, students' current grades, and help instructions to class listserv and ftp. Students are encouraged to develop their own web pages for this class or use IRC if they feel it necessary. However, the class does not technically support IRC. Other technologies to be used include fax, FedEx, priority mails, first class mails, and phone calls. For a detailed description of technology use, see (Zhang 1997).

COURSE DELIVERY

The course was delivered in the spring 1997 semester. A total of 16 students registered and showed up on the first day of the residency period. One student decided to drop the class after the first morning because he felt the course workload would be too heavy for him. Among the 15 students, one is from Japan, one from Spain, one from Canada, and 12 from five states of the United States (LA, NY, PA, SC, and VA). Fourteen finished the SA&D course on time. Student N reported that she had family problems and technology problems during the semester. Although the instructor and the TA tried very hard to help her, she did not pass the course. Nine out of the 14 students were taking one other distance course, while one student was taking two other distance courses at the same time.

Starting from the residency, the progress of the course was just as what was planned in terms of subject content and time schedule. Little change or adjustment was made. To the instructor's surprise, three out of 16 registered students did not turn in the pre-questionnaire on time, and five did not turn in the project proposal on time. Thus a class policy was announced on the first day of residency, stating that any overdue assignment would incur penalty of 10% off total points of that assignment for each day late. After the residency, a few students turned in some of their assignments one or a few days late with no excusable reasons, and they learned right away how costly being late was. Subsequently, for the rest of the class, there were few late submissions except two cases in which the two students involved were hospitalized around the time the assignments were due. Since we anticipated the possible late assignments when planning the time schedule, there was little impact on the students' completion of consequential assignments.[5]

Actual technology usage data are collected and thoroughly analyzed (Zhang 1997). One fact indicated by technology use data is that there was very little class wide discussion among students, particularly over the listserv. Students tended to seek help directly from the instructor first. In this course, students were not required to contribute to the listserv, nor were they evaluated by how much contribution they provided to the class listserv. Without this pressure, the class wide listserv seems very quiet. No student complained about this, although one student pointed this out as an interesting fact during an email conversation with the instructor.

DISTANCE LEARNING RESULTS

In this section, we report what happened on the students' side. We quote some of the students' comments to give readers the feel of the learning results. Specifically, we provide evidence on effort, collaborative learning and role playing, and satisfaction. The evidence comes from student comments on post-questionnaires and project reports. The post-questionnaire at the end of the class also collects data on students' self-assessed competency achievement, which is summarized in the section.

Effort

". . . I must have re-written the project proposal ten times as I thought of more data points to consider . . ."

"My analyst and I made sure we were in contact almost everyday . . ."

"My analyst and I often sent 6-10 e-mails per day. We used The Palace to communicate synchronously." [6]

Collaborative Learning and Role Playing

"The questions posed and feedback received as a customer gave me a deeper insight into my role as an analyst. In turn, I was able to be more helpful and thorough as a customer because of my work on the analyst's side of the project."

"As an analyst I also learned a few other things. First, the customer often knows more than they can communicate. The more time you spend with the customer, be it in person, by email, fax, phone or IRC, the more knowledge of the system you're going to pull out of them. Milestones were discovered when knowledge was pulled from the customer. . . .this brings up humanistic skills. I also found that it is important to not let the customer feel bad about (things they forgot to tell or small errors) . . ."

"In conclusion, this project was extremely useful. While I learned the most playing the part of an analyst I would not want to have given up the part of the customer either. Even if I am usually analyzing systems I now have more 'bed-side manner' than I otherwise would have."

"My role as a system analyst in this project lent me insight into the field and provided me with knowledge and experience that can be carried over into other business roles."

"As a customer I found a number of things quite interesting. First, in my role of 'business professional' I found that to put forth a good proposal I had to do a lot of thinking and research ahead of time. For me, this was a surprise. ...What I learned is that if I am a customer I will have a much more positive, easy and successful customer-analyst interaction if I do some research and put out an intelligent new-systems request. I feel I saved a lot of time (by doing so). ... If I were paying an analyst for this time, I would want to save as much time and money as possible."

Satisfaction

"As the president of my organization, I have gained tremendous insight into what will be required to move the organization forward, as well as some of the pitfalls to avoid. I am now equipped with concrete tools to move us from an antiquated manual system to a simple, easy-to-use automated system. Thanks to this project I have a pretty good idea how to get it done."

"I don't know by now if the work done is correct, but I feel satisfied, because I've learned many things. Specially I've learned how to approach a project first."

"Thanks for a great class. I learned a lot (even I have been an analyst for 10 years) and enjoyed meeting you. I hope to have you for another class later in the program."

"I have learned a great deal in this class and this exercise in particular. I had NO experience in SA&D. While I found the course very challenging I feel that I will take with me a plethora of skills that I will be able to use in my new vocations."

"This project has taught me a great deal about an organization I thought I knew well... As a person who is employed full-time in the information technology field, I have received substantial job-

related benefits from this experience. Already I have put the knowledge I've gained to good use evaluating and planning information management projects at work... I am glad to know that my employer (who is paying my tuition) is getting its money's worth. More importantly, I'm pleased that my investment of time and effort is paying tangible professional dividends."

Other Comments

"A fairly large concern of mine was the lack of time we had in class to discuss more fully some practical examples of the modeling techniques."

"As a student, this project and this course have provided me with some very helpful ideas about what I do and do not want from a career in information technology, and what academic choices will get me where I want to be."

"When the final version was handed to me to sign, I was satisfied and convinced that this was the solution and that we will implement it into our system. As a matter of fact we already have."

"I found that managerial skills were an important part of this project. Coordinating communications, juggling the various diagrams on a concurrent basis and meeting deadlines were all important. It made me and my customer feel good to put parts of the project to bed and finish within our given time allotment."

"Most of us will have some familiarity with DFD. More weight should be placed on EER and OOA."

"Having to start from scratch and proceed to a reasonable level of completeness was also very good to me. At times in the beginning I felt that I would never have a reasonable product designed, and at times toward the end I wished I could let an underling finish the grunt work. But it gave me an idea of what system analysis is all about. All in all a very demanding and very rewarding assignment."

Students' Self Assessment of Competency Before and After Class

The post-questionnaire asked the students to assess their before-class competency, which was already asked in the pre-questionnaire, and after-class competency. The assessment for after-class is similar to that in Pre-questionnaire Part C except that, (1) there are two rows for each item: before and after; and (2) items C2, 6, 7, 11 are

TABLE 1

SELF-ASSESSED SA&D COMPETENCY: CLASS AVERAGE SCORES

Class Average on Items [a]	C1	C2	C21	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C21	Average
Before (pre-q) [b]	2.1	2	n/a	1.7	1.7	1.5	2	1.9	1.5	2.8	2.7	1.8	2		2.02
Before (post-q)	2.4		2.3	2	1.8	1.2			1.5	3.3	2.6		2.3	2.3	2.23
Before (average)	2.3		2.3 [c]	2	1.8	1.4			1.5	3.1	2.7		2.2	2.3 [d]	2.22
After	4.5		4.3	4.3	4.5	3.3			4	4.7	4.6		4.2	4.3	4.28
Gain	2.2		2.1	2.3	2.7	1.9			2.5	1.6	1.9		2	2	2.06

[a] For the meaning of each item, please refer to Part C of Appendix A, the pre-questionnaire. For C21, the item is "System boundary and requirement specification."

[b] Some data items (in italic) were asked before the class. However, they were not covered in the class. Thus these items were not asked to the students at the end of the semester. The Average for the row does not include these non-covered items.

[c] Since this item was asked only once, the score is used as the average of the item.

[d] This item was asked only at the end of the semester, the score is used as the average of the item.

dropped, and C21 is added. Table 1 lists the summary of the competency data.

It is interesting to notice that the two assessments of before-competency agree with each other (average difference is less than 0.5 per item) for most students except two. One student lowered the second assessment by an average of 1.06 per item. This student has ten years real world experience of being an analyst, but little formal training. It is possible that after taking the course, he realized that there was more to learn beyond what he thought he already knew. The other student, on the other hand, took a SA&D course many years ago and applied some of the concepts in real world projects. The course reminded her a lot of the things she had almost forgotten. Thus her second assessment is considerably higher than the first one (an average of 1.34 per item). In fact, the second assessment looks like as if except object-oriented analysis, she learned nothing from the course (there are no differences between before- and after-competency for all the items except OOA).[7]

On an average, the class gained more than two scales on most items. C9 communication and collaboration gained least (with a gain of 1.6) since students were already "literate in it" before the class (with a score of 3.1). A gain of 1.6 is, however, a very significant achievement for this skill that is vital for all full-time working people. Among three analysis techniques, Object Oriented analysis was the lowest expertise students had before class (with a score of 1.4) and was the least improved (with a gain of 1.9). Students also commented in other places that they wished the class could spend more time on it. This suggests a change in future SA&D course designs and deliveries.

DISCUSSIONS AND SUGGESTIONS

We conclude that under the guidance of the four distance education philosophies discussed early, the SA&D distance course met the students' needs, was successfully delivered, and achieved high student learning satisfaction. The learner-centered view makes the course fit the needs of this particular group of distance students. Distance instructors should do a thorough analysis of learners. Only if the course objectives are consistent with, if not identical to, the learners', can effective learning be possible.

Although students are in control of their own learning, as suggested by several distance education researchers, this author's experience is that they still need structure (what to do, how to do, why to do, when to do) and reinforcement, as well as timely feedback that is in the context of their own learning experience. As one student pointed out:

"I felt I learned a significant amount in this course. The workload was heavy, and deadlines were enforced, but this improved learning."

With the exception of subscribing to the listserv, no technology was mandatory. Students reported little frustrations with computer technology. Technology did not function as a distracter, thus students could concentrate on the subject matter. However, on the instructor's side, there were times that on-line assignments could not be accessed due to different software or software versions used. In several of the worst situations, a total of four to seven emails were sent back and forth between the instructor and the students before the assignment was finally delivered successfully. The instructor found that the most efficient way for receiving assignments is fax, although there were times that entire reports were missing, or pages were missing.

The following are several other important aspects we have experienced. Some of these issues propose further discussions and need more experiment. Some of the difficult situations could be avoided or minimized if we would have known them ahead.

Distance Instructional Workload Distribution

Distance courses take a considerable amount of effort and time for up-front preparation, compared to traditional courses. A well-planned course needs little adjustment. It is, however, very important to anticipate potential problems that might happen along the way and leave room for adjustment if necessary. Changing course objectives or content can be very frustrating to the students. For example, one student commented that:

"I thought you were an excellent teacher and one of the FEW that kept up with the responsibilities of your DISTANCE students - too often we tend to get ignored by the professors and you are the only one that made and stuck to the schedule for the class. I feel that by doing this a lot more learning took place than with certain other professors."

The distance program director of the degree program also pointed out that

"(Some) faculty seem unprepared to teach in a distance format. As faculty struggle to keep up with the technical troubleshooting, answering emails, and contributing to class discussions, they fall behind. This makes it appear that faculty aren't devoting enough time to the class. Also, as time runs out at the end of the semester, things get dropped from the syllabus, making students feel like they didn't get their money's worth."

The Roles of Distance Instructors

Some researchers defined the role of distance teacher as "a facilitator of learning rather than a communicator of a fixed body of information." (Jonassen 1992) Our experience disagrees with this definition. The traditional instructor's roles are not completely gone. Communicating of information, knowledge, and perspectives of a subject field is still a very important task for distance instructors. The new challenge is to be more effective in communication, both oral and written (for example through emails). Distance students still need guidance to acquire information, knowledge, skills, and perspectives. The traditional enforced learning still works in a distance mode.

Distance students seem more demanding of their instructors. They want immediate feedback, more feedback, and more understanding from the instructor. Distance instructors need to be prepared to properly handle this situation.

Class Policy

A pitfall for distance teaching is the tendency to place too much trust in students. Many useful class policies may be dropped from the traditional courses when the courses are redesigned for distance students. This is actually not distance students' fault. Both distance instructors and distance students play multiple roles in their lives. As in any civilized community, well-defined and agreed class regulations and policies will make everyone's life easier. When making class polices, distance instructors are challenged to (1) be more thoughtful, (2) keep on top of the work and communicate well with students about the policies, and (3) stick to the policies. Making good policies and executing them will cause students less frustration, confusion, and disappointment, and enable the instructor to be more efficient.

Possible policy issues are: (1) time frame for assignments (as the late charge policy in this course), (2) delivery methods for assignments (some distance instructors only accept hard copies of assignments via mails), (3) software applications and versions, and (4) email response frequency or time frame.

Administration of Distance Teaching

Compared to traditional teaching, distance teaching requires an instructor to have stronger organizational skills and time management skills due to much heavier class administrative needs. A teaching assistant can help only to a certain extent. Most of the time, the instructor needs to face the administrative challenges. Here are some suggestions to reduce the administrative cost. (1) Always keep a copy of everything that is to be sent to the students, or some agreements with students, so that future recall effort can be minimized; a context can be constructed quickly for a conversation; a misunderstanding can be diagnosed and clarified; and a copy can be obtained should things get lost during the delivery. Organize logically to allow fast retrieval. (2) Discover a way of tracking assignments with minimum effort. The author found that it was very time consuming and overwhelming to keep a record of when who turned in what. A distance teaching colleague offered a great idea: use pre-printed address labels for each assignment, then time stamp each received assignment by putting the label on the received assignment. The remaining printed labels would be the people whose assignment is not yet received. So the address labels become a mechanism for assignment management! (3) Use a separate email address for the course. Using the instructor's personal email address in this SA&D class was a big mistake and very costly to the instructor. Email messages also need to be well organized to ensure minimum retrieval effort. (4)

Handle teaching issues at certain time of the day (which should also be stated as class policy) so that other tasks can be done. (5) Be prepared for technology failures. Any technology can fail at any moment. The impacts of technology failures can be on class communication and course work delivery. Design alternatives and enforce acknowledgment of receipt between parties so that less damage is caused.

ENDNOTES

1. In the data collected and analyzed, we withdraw the questionnaire of hte student who dropped the class on the first day of residency.

2. The real reason of this student selecting "conflict" was not clear. However, it turned out that this student failed the class. We name this student as Student N. See later sectons.

3. This student enrolled in the degree program in Spring 1997.

4. Not shown in the paper. Interested readers can contact the author for a copy of this part.

5. Except Student N, who stopped submitting assignments in the middle of the semester. In the project where she was the customer, the analyst of the project managed to finish the project with help from the instructor and the TA. In another project where she was the analyst, it is unkown how much effort she put into the work, as she never turned in the report, even though she said she finished it.

6. Author's note: this student lives in Japan, his partner in the U. S. The Palace is a graphical IRC tool.

7. In other places, she commented that she learned a great deal in this class, especially dealing with someone who has little experience in the information systems field during the team project practice. The competency assessment is not the only place ot evaluate learning effectiveness.

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APPENDIX A.

LEARNER SURVEY: PRE-QUESTIONNAIRE

This questionnaire is designed to get some background information about each student so that the professor can adjust teaching accordingly. No identity is needed. However, there will be other questionnaires during the semester and there is a need for matching the same student with different questionnaires. So please use a pseudo-code consistently as your ID. You are suggested to use your mother's middle name followed by the month and day of her birthday, e.g. my ID would be Li0909.

ID: **Date:**

Part A. Questions about yourself (demographic data)

1. Which best describes your educational background (circle best choice):
   a. technical c. managerial
   b. behavioral d. other ____________________

2. Which degrees do you hold so far (circle all that apply):
   a. BA in (area) __________ e. MBA
   b. BS in ____________ f. Ph.D. or Doctoral in ________
   c. MA in ____________ g. other________________
   d. MS in ____________

3. You have been working in Info. Systems analysis or design field for _____ years.

4. You have been a user of (managerial) Info Systems for ______ years.

5. You have been involved in management of Info Systems or resources for _____ years.

6. You have been involved in managing IS (project) development for ______ years.

7. You have been involved in managing IS professionals for ______ years.

8. You have taken a similar course about _____ years ago.

9. You have _____ years of team work experience (closely work with others on any type of work)

10. Top two reasons you decided to take this course (circle up to two):
    a. degree required/advised to take
    b. only available course at the time
    c. preparation for getting in degree program
    d. market driven (big market out there)
    e. gain knowledge, skills, experience
    f. update old knowledge, skills
    g. professional enhancement
    h. new career path
    i. just interested in the topic
    k. professor's reputation
    l. other ____________

11. Presently you are _____ years old.

12. Your gender is a. male b. female

13. Currently you are in
    a. ISDP-IRM e. MLS
    b. ISDP-MLS f. TNM
    c. ISDP-TNM g. other ______________
    d. IRM

Part B. Questions about your learning objectives

1. Your learning objectives for this course are from (circle all that apply):

a. course syllabus
b. other course materials ______________________
c. friends or peers or advisor
d. your own
e. other ______________________

2. You feel that your objectives and those specified in the syllabus are

a. identical
b. consistent
c. conflict

Part C. Assess your current expertise & competency:

Competency: None-> High
1: no awareness
2: can recall and recognize it
3: literate in it
4: grasp all key concepts
5: capable of applying it to situations of at least intermediate complexity (such as a project)

1. SDLC concept and stages	1	2	3	4	5
2. Organizational activity modeling	1	2	3	4	5
3. Conceptual data modeling (ER, EER)	1	2	3	4	5
4. Process modeling (different level DFDs)	1	2	3	4	5
5. Object-oriented analysis	1	2	3	4	5
6. Logic modeling (decision tree/table, structure chart, state transition)	1	2	3	4	5
7. Data normalization & definition (with any RDB)	1	2	3	4	5
8. System synthesizing (combine data, process, logic, etc. models together)	1	2	3	4	5
9. Collaboration & Communication	1	2	3	4	5
10. Project identification, initiation, planning	1	2	3	4	5
11. CASE tools concept and role in SDLC	1	2	3	4	5
12. Managerial issues involved in system life cycle	1	2	3	4	5

SURVEY OF DISTANCE EDUCATION UTILIZATION IN INFORMATION SYSTEMS DEPARTMENTS

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A survey was conducted of 205 information systems departments to determine information about existing distance education programs, plans for future distance education programs, faculty selection and training, and advantages and disadvantages of distance education.

Of the questionnaires returned by 46 information systems departments, only 12 were actually using distance education in their programs; however, an additional nine departments planned to use distance education within two years. Lack of funding, equipment, administrative support, and faculty support were given as reasons why 18 of the information systems departments did not see distance education as a viable learning program.

The most popular media used for distance education were Internet or Web-based instruction and interactive television (ITV). The reporting information systems departments were offering about the same number of undergraduate and graduate courses via distance education.

Half of distance education faculty received no additional remuneration of released time for distance education assignments. The most popular type of training was specialized on-campus workshops and personalized one-on-one training or mentoring.

INTRODUCTION

Distance education is the buzzword on many college and university campuses. For many, "distance education" refers to two-way interactive video as the delivery system; however, in the last two or three years, an increasing number of courses are being offered through the World Wide Web. Dighe (1996) sees electronic training (or distance education) resulting in educational reform through availability of top-quality education not restricted to academic location.

Although the term, distance learning, is frequently used, Holmberg (1989) and Keegan (1990) suggested distance education is a more appropriate term because distance learning (for students) and distance teaching (for teachers) are subterms for the broader, more inclusive term of distance education.

A simple definition of distance education is instruction or education which occurs when educator and learner are separated by distance (Verduin & Clark, 1991). Willis (1993) expanded that simple definition to give a commonly accepted definition of distance education today:

> At its most basic level, distance education takes place when a teacher and student(s) are separated by physical distance, and technology (i.e., voice, video, data, and print) is used to bridge the instructional gap. (p. 4)

This paper will discuss: (1) the definition and terminology of distance education, (2) the history and background of distance education, and (3) distance education utilized by information systems departments.

BACKGROUND

The British were at the forefront of distance education, providing correspondence education at Oxford (1857) and Cambridge (1858). The U.S. offered university extension programs as an extension of the lyceum and Chautauqua movements in the mid 1800s. Illinois Wesleyan University offered the first correspondence program in the U.S. leading to a degree in 1873. By the 1910s, several universities (Chicago, Wisconsin, Kansas Texas, Nebraska, and Minnesota) by 1910 had extension or correspondence departments (Watkins, 1991).

The correspondence study of the 1800s were provided through printed text on paper. By 1910-1920, lantern slides and motion pictures were added to correspondence or extension study, followed by radio instruction by the 1920s (Sherow & Wedemeyer, 1990). In the 1940s, records and film were added to correspondence materials. By mid 1950s, several universities were offering one-way television as part of correspondence study in the mid 1950s (Wright, 1991). The University of Wisconsin, a leader in correspondence education in the U.S., was using private line audio networks, freeze-frame video, and telewriters (Baird & Monson, 1992). By the 1960s, correspondence study was used less and less, as one-way televised instruction became popular. Correspondence study was often perceived as a lower-quality mode for distance education.

A wide array of different technological delivery systems were used in the 1980s. Computers and electronic bulletin boards began to be used for some independent study programs (Wright, 1992). Also, during the 1980s, some universities such as Auburn University started videotaping instruction which was used for students at a distance--not on campus. Distance education was now using two-way audio and two-way video (Garrison, 1990).

By the 1990s, Internet or web-based courses began to gain momentum. Web-based courses have become quite popular as stand-alone courses or used in conjunction with two-way interactive televised courses. Web-based instruction, though very similar to the print-based correspondence study of the past, has not suffered from a perception of a lower-quality educational product.

What is required of distance education teachers? Distance education authorities (Gunawardena, 1990; Keegan, 1993; Moore, 1989; Willis, 1993; Zaborowski, 1993) suggest the following precepts for teaching via distance education:

1. Personalizing (focusing on individuals)
2. Interacting (providing opportunity for student participation)
3. Planning delivery or presentation style (planning for learning enhancement)
4. Providing feedback (devising feedback to determine effectiveness of instruction, to clarify misunderstandings, and to answer questions)

Are information systems departments utilizing distance education in programs and/or curricula? Anecdotal evidence suggests mixed answers. As leaders in technology, information systems departments frequently are at the forefront of new innovations. Many information systems professors are using Web-based technology for supplementing course assignments. When considering two-way interactive video or television, however, information systems departments appear to be lagging behind other business departments in the offering of distance education courses. Thus, a secondary objective of this study was to determine the status of distance education in information systems departments.

DISTANCE EDUCATION IN BUSINESS SCHOOLS

Many articles appear in the literature about the use of distance education for business classes (Magiera, 1994; Shorter & Johnson, 1994). A entire issue of the Journal for Education for Business (1996, March/April) was devoted to distance learning. Interestingly enough, very few of the articles describe information systems classes being taught via distance education. Wachter & Jatinder (1996) reported use of interactive television for teaching information systems at Ball State University; this MBA-level IS course has been offered via distance education since 1986. Bialac & Morse (1995) also described a graduate MIS course, Information Systems Concepts, offered via distance education at Georgia College & State University.

While two-way interactive television (or teleconferencing) was the buzz word in 1995, recent literature has focused on web-based or Internet courses as a distance education medium (Hall, 1996; Manjourides, 1997). Likewise, an increasing number of distance education classes were adding web-based instruction to the interactive television course (Wheeler, Batchelder, & Hampshire, 1996).

FINDINGS OF THE STUDY

The authors surveyed 205 schools listed in The College Blue Book as having departments of information systems (IS), management information systems (MIS), computer information systems (CIS), or business information systems (BIS). During December 1994 through January 1995, a five-page questionnaire was sent to the department chairperson of each of these 205 schools determining distance education usage by the department. Forty-six of the 205 schools returned usable questionnaires (a return rate of 22.4 percent). Only 12 (26.9%) of the 46 IS departments were using any form of distance education for IS classes; however, the questionnaire determined whether the 34 departments not using distance education had plans for using distance education in the future and the reasons why they were not considering distance education as a viable learning program.

Future Plans for Distance Education

Thirty-four of the information systems departments were not using distance education. Of the 34 schools not using distance education, 16 (34.8%) indicated plans to use distance education in the future. As shown in Table 1, nine of the 16 information systems departments (56.3%) were planning to use distance education within the next two years. Three of the IS departments (18.8%) were in the feasibility/ analysis stage, and four (25.0%) were uncertain when they would be using distance education in their departments.

TABLE 1

FUTURE PLANS TO USE DISTANCE EDUCATION IN INFORMATION SYSTEM DEPARTMENTS

Plans to Use Distance Education	No.	Percentage
Within next 12 months	5	31.3%
Within next 18 months	3	18.8%
Within next 24 months	1	6.3%
Feasibility/planning stage	3	18.8%
Unknown	4	25.0%
TOTAL	16	100.2%*

*Percentage is more than 100 percent because of rounding.

Reasons for Not Considering Distance Education

Table 2 presents reasons given by the 18 IS departments not considering distance education. A majority of the 18 IS departments listed lack of funding, lack of equipment, lack of administrative support, and lack of support by faculty members as reasons for not considering distance education.

TABLE 2

REASONS INFORMATION SYSTEMS DEPARTMENTS WERE NOT CONSIDERING DISTANCE EDUCATION

Reasons	No.	Percentage
Lack of funding	15	83.3%
Lack of equipment	13	72.2%
Lack of administrative support	10	55.6%
Lack of faculty support	12	66.7%
Other	4	22.2%
TOTAL	--*	--*

*Total is more than 18, and percentage is more than 100 percent because respondents could give more than one reason for not considering distance education.

Utilization of Distance Education Media

Twelve of the 46 IS departments reported utilizing some form of distance education media. As shown in Table 3, the 12 schools utilized a variety of distance education modes or media for classes. Most used more than one type of media. Internet or web-based instruction was the most commonly used distance education medium (58.3%) with two-way interactive television (ITV) used by 50 percent of the information systems departments. When combining both one-way and two-way ITV, 66.7 percent of the IS departments were using ITV for distance education delivery.

Reasons Departments Offer Distance Education

Why do IS departments offer distance education classes? Nearly sixty percent (58.3%) cited

TABLE 3

DISTANCE EDUCATION MEDIA USED BY INFORMATION SYSTEMS DEPARTMENTS

Distance Education Media	Number	Percentage
Internet or web	4	58.3%
ITV (two-way)	6	50.0%
ITV (one-way)	2	16.7%
Video	4	33.3%
Correspondence	4	33.3%
CI (one-way)	2	16.7%
CI (two-way)	2	16.7%
Other	1	8.3%
TOTAL	--*	--*

*Totals are more than 12, and percentages are more than 100 percent because some departments used more than one distance education medium or media for delivering distance education.

saving students travel and time from remote sites as a main reason for offering distance education classes. About one-fourth indicated they offered classes via distance education that would not normally have enough students to support an on-site faculty instructor.

The IS departments reported a variety of different course titles in which distance education was utilized. Distance education course offerings for the 12 departments were almost evenly split between undergraduate and graduate offerings. One-third of the departments offered only undergraduate courses via distance education, and one-fourth offered only graduate classes. Another one-third of the departments offered both undergraduate and graduate courses.

Faculty Remuneration, Teaching Load, and Assignments

As Table 4 shows, half of the 12 IS departments provided no remuneration or reduction in teaching load. Four of the IS departments gave a reduced teaching load either for the current term or prior to the distance education assignment.

TABLE 4

REMUNERATION OF FACULTY FOR DISTANCE EDUCATION

Renumeration	Number	Percentage
None	6	50.0%
Additional payment	3	25.0%
Reduced teaching load for current term	3	16.7%
Reduced teaching load for prior to distance education assignment	2	16.7%
Extra credit or points for salary	1	8.3%
Extra credit or points for tenure	1	8.3%
Total	- -*	- -*

*Number is more than 12 and more than 100 percent because respondents could list more than one type of recnumeration for distance education instructors.

Three departments gave an additional salary or payment for teaching via distance education. Only two departments gave extra credit or points for either salary or tenure.

A majority (66.7 percent) of the IS departments offering distance education reported that faculty members volunteered for distance education instructional duties, and 33.3 percent were assigned distance education duties by either administrative personnel or senior academic staff members.

One of the concerns was how faculty received training for teaching via distance education. Table 5 shows that the largest percentage (58.3%) attended specialized distance education workshops on campus. No department reported attending specialized distance education workshops off campus. Half of the respondents received one-on-one training or mentoring. Approximately one-third of the IS departments indicated they received training via printed instruction books or manuals. One-fourth of the respondents said they received no training.

Table 5

TYPE OF TRAINING PROVIDED FOR DISTANCE EDUCATION FACULTY

Type of Training	Number	Percentage
Specialized workshops/ seminars (on-campus)	7	58.3%
Personalized one-on-one training or mentoring	6	50.0%
Written instruction manuals	4	33.3%
Videotape tutorials	1	8.3%
No training	3	25.0%
TOTAL	- -*	- -*

*Total is more than 12 and percentage is more than 100 percent because the 12 respondents could list more than one type of training for distance education faculty.

Advantages and Disadvantages of Distance Education

Tables 6 and 7 present the advantages and disadvantages of distance education as reported by the 12 IS departments. The highest percentage of respondents (66.7%) reported the ability to network with students at a distance as an advantage of distance education, and half cited the political advantage within the university/college environment as an advantage. Competing with other colleges and the opportunity to develop the state of the art technology were also given as advantages of distance education. Instructor cost savings was mentioned only by 16.7 percent of the departments.

In Table 8 shows, 83.3% of the IS departments listed the extra time and effort in preparing for distance education as a disadvantage with 58.3% reporting the lack of personalization for distance education students as a disadvantage. Lack of faculty availability for students and the reluctance of faculty to teach distance education courses was given as disadvantages by 41.7 percent of the information systems departments. Not surprising, 33.3 percent of the IS chairs indicated that the expense of the distance

TABLE 6

ADVANTAGES OF DISTANCE EDUCATION REPORTED BY INFORMATION SYSTEMS DEPARTMENTS

Advantages	Number	Percentage
Ability to network with students at a distance	8	66.7%
Political advantage within college/university environment	6	50.05%
Competing with other colleges/universities	5	41.7%
Opportunity to develop state of the art technology	4	33.3%
Instructor cost savings	2	16.7%
Promotion of joint programs	1	8.3%
Other	1	8.3%
Total	--*	--*

*Total is more than 12 and percentage is more than 100 percent because respondents could give more than one advantage.

education equipment was a disadvantage.

CONCLUSIONS

Based on the findings, the following conclusions are presented:

1. Slightly more than one-fourth of the IS departments were actually using distance education; however, an additional one-fifth were planning to use distance education within the next two years. Savings of travel and time for students was given as a main reason for offering distance education courses.

2. Lack of funding, lack of equipment, lack of administrative support, and lack of faculty support were the main reasons that IS departments gave for not considering distance education for their programs.

TABLE 7

DISADVANTAGES OF DISTANCE EDUCATION REPORTED BY INFORMATION SYSTEMS DEPARTMENTS

Disadvantages	Number	Percentage
Extra time and effort for d.e. preparation	10	83.3%
Lack of personalization for d.e. students	7	58.3%
Lack of faculty availability	5	41.7%
Reluctance of faculty to teach d.e.	5	41.7%
Expense of equipment	4	33.35
Other	2	16.7%
Total	--*	--*

*Total is more than 12 and percentage is more than 100 percent because respondents could give more than one disadvantage.

3. A majority of IS departments offering distance education were using Internet or web-based instruction and interactive television as distance education media.

4. Half of the IS departments offering distance education provided no extra remuneration or released time for faculty with distance education assignments. Most of the training for distance education faculty was provided by specialized on-campus workshops/ seminars.

5. A majority of the IS departments listed advantages of distance education as the ability to network with students and political advantage within the university environment.

6. The two main disadvantages of distance education were given as the extra time and effort for distance education preparation and the lack of personalization for distance education students.

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THE IS MBA CORE COURSE: FOSTERING STUDENT CREATIVITY WHILE ENHANCING ACTIVE LEARNING

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This paper describes the results of re-engineering the IS MBA core course in a private Northeastern university. In an effort to keep the course material as current as possible, the use of a textbook was eliminated and was replaced with a number of different assignments. The assignments required the students to become active learners instead of passively listening to lectures. The course is continually evolving based on student feedback and emerging technologies.

INTRODUCTION

Teaching Information Systems courses places special demands on IS faculty to continuously update their curriculum. While this is true in graduate as well as undergraduate courses, it is vital in the core IS course in the MBA. At many institutions that offer an MBA, students are required to take only one IS course. This may be the sole IS course that students will take at the graduate level.

While a lot of excitement is often associated with the potential value of Information Technologies, the benefits for a specific business may be nonexistent. Numerous examples exist in the literature where Information Systems have not been successfully implemented (Okolica and Stewart, 1996; Stewart, 1992; Manross and Rice, 1986; Markus, 1983). An objective of the core course is to teach students about the potential benefits, dangers and limitations of IT (Silver, Markus, and Beath, 1995).

Individuals retain more information when they are active learners (Shnell, 1986; Wittrock, 1986). Students' roles and responsibilities in teaching and learning decisions are increasing (Godfrey, 1995). Group problem solving and collaborative learning enable students to reveal different views, to come to a consensus, and to develop a more comprehensive understanding of the subject matter. Additionally, students express satisfaction with the collaborative learning environment, describing the process as a "positive emotional learning climate." (Alavi, Wheeler, and Valacich, 1995). Collaborative learning improves retention (Keeler and Anson, 1995). Through collaborative learning, students learn to take advantage of each team member's expertise and also experience first-hand the problems of coordinating team effort (Goyal, 1995/1996).

In this paper we share some of the ideas that worked for us in integrating two primary objectives of the core IS course in the MBA: keeping the content of the course current while actively involving the students in the learning process.

STUDENTS' BACKGROUND

At Dowling College students can choose from among five different MBA concentrations: Banking and Finance, Total Quality Management, Aviation Management, General Management, and Public Management. Each concentration requires students to take the core IS course, Information Technologies for Managers.

The students come to the course with varied backgrounds. Most of them have taken one or two general IS courses as an undergraduate and currently work with personal productivity packages. Some of the students work in entry level or clerical type jobs while others are in middle or upper level management. One or two students usually work in IS or related fields. Class size varies from 15 to 25 students.

THE COURSE

The focus of the course is the use of Information Technology from the perspective of management. Managers need to think about how to use IT to leverage resources for businesses and to help employees function more effectively. However, IT innovations are often very costly and not always successful.

Technology Watch

The major assignment in the course is the Technology Watch. The purpose of this assignment is to learn how to investigate, evaluate, implement, and manage new Information Technologies and to understand their potential effects on business organizations.

The assignment is presented to the students at the first class session. They are given two weeks to decide which topic they wish to report on. Students work on this assignment in groups of two or three.

Students are required to make an oral presentation to the class. The presentation usually lasts approximately twenty to thirty minutes. By making an oral presentation to the class, students learn to speak in front of a group while at the same time, the rest of the class is learning about current Information Technologies. Students are taught presentation skills and are required to use PowerPoint for their presentations

The issues that students address in their presentations include:

- Describing the IT.
- Discussing the advantages of using the technology.
- Discussing the technologies' effects on productivity.
- Examining if there are any problems with the technology.
- Describing how different companies are using the technology.
- Identifying the types of organizations most likely to benefit from the technology.
- Describing the job opportunities regarding the technology.
- Identifying the critical success factors in implementing the IT.
- Discussing the future for this technology.

Among the topics that students have reported on are:

Electronic Commerce (digital cash, forms of cash and credit, authorization, verification, transaction processing, legal and consumer issues, security issues, smart cards, etc.)

Internet Security (identifying, preventing, and controlling unauthorized access and modification, firewalls, encryption, cybercops, outages, insurance, etc.)

Commercial on-line services and internet access providers (access options, direct connections, ISP's, commercial on-line services, ISDN, ADSL, tips for picking an ISP, leading ISP's, compare and contrast attributes, costs, customer base, policies, etc.)

Corporate intranets and extranets (what they are, hardware requirements, information available on, benefits of, must include extensive case studies).

Alternative work sites (virtual office, road warriors, telecommuting centers, who uses, impact, future)

Groupware and meeting support software (Lotus Notes, GroupSystemV, Explorer, impact of Internet etc.)

Geographic information systems (including global positioning systems and applications in areas such as transportation, travel, military, etc.)

Voice recognition systems (both generic and trainable systems, business applications, etc.)

Web sites (what makes a good and bad Web site, creating and managing company and personal web sites, costs/revenue)

The class is encouraged to react to and evaluate the presentations. Many students will bring in relevant articles on the appropriate evening. Other students are able to relate the topic to their own businesses. Lively discussions often ensue. Through the Technology Watch assignment, students take responsibility for sharing recent findings regarding emerging Information Technologies.

PC Selection

A second assignment is the PC Selection. In the past, when the majority of students did not know what megahertz, RAM, gigabytes, etc. were, all students were required to go out and price a PC. By speaking to actual salespeople, students were forced to understand and use the correct terminology. This was further reinforced in class. After each student had priced a PC, the class compared the different prices and chose a "best buy".

This assignment changed as more students owned a PC and became familiar with PC hardware terminology. Presently, at the first class session, students complete a short questionnaire regarding their PC background. Based on the questionnaire results, the students are subsequently divided into groups. One group is responsible for comparing desktop machines, both retail and mail order. Each student in the group is asked to go to a store as well as call a mail order vendor. The group then makes a recommendation based on a number of criteria (price, processor, MHz, RAM, warranty, service, etc.). Students in this group have never owned a PC and are totally unfamiliar with the terminology. Having to use these foreign terms is a real learning experience for them. They begin to feel a sense of confidence in their abilities to converse in a technical area.

A second group is responsible for comparing portable PC's, both mail order and retail. Students assigned to this group have never owned a laptop. By completing this assignment, they become familiar with the configuration of a laptop versus a desktop machine. They learn about active and passive screens, PCMCIA cards, and different pointing devices.

A third group is responsible for researching what is involved in upgrading a PC. This group consists of students who are thoroughly familiar with PC terminology and have owned both desktops and laptops. They are responsible for pricing different components, such as monitors, modems, memory, and ergonomic keyboards. This group will bring to class a laptop and a desktop PC and discuss what is involved in upgrading them. They usually will take apart the desktop PC and identify the motherboard, memory, expansion bays, expansion slots, etc. This enables those students to whom these terms are abstract and somewhat confusing to actually see what we have been talking about.

The last group is required to discuss a current topic related to PC's. This group has had the most experience with PC hardware. They typically include individuals who have upgraded a PC and have owned a PC for a number of years. This group is responsible for discussing the cost of maintaining PC's in organizations. They research the pros and cons of NC's versus PC's. They examine the hype of NC's against the reality.

By working in groups based on PC experience, students are able to learn at their own level. Those who are not familiar with terminology get to use it in real life situations whereas those who are at a more advanced level research the Total Cost of Ownership of PC's in organizations.

Internet

The purpose of the Internet assignment is to learn to use the World Wide Web as a strategic advantage in business. To this end, students are asked to examine their company's Web site and compare it to that of their competitors. They explore ways in which their company can enhance their Web site. They examine Web sites analytically while learning more about their own company. One student commented after examining her company's Web site that this assignment "strengthened my good feelings about my company and the direction it's going in. It made me proud to be an employee of the company."

Students who are not working, or whose companies do not have a Web site, are asked to examine the Web site of a company they wish to work for, analyze the site, and compare it to competitors.

The Internet assignment will continue to evolve as students become increasingly familiar with the Web. At this point, many of our students have never been on the Web or have just used it in a very superficial way. One student indicated that "Before this class, I can honestly admit that I was afraid of trying to use the Internet. I never thought it would be this easy. As a result of this assignment, I purchased a modem and now subscribe to an Internet Service Provider."

An alternative Internet assignment might focus on search engines and using the Web for research purposes. Prepare specific targets on the Web for students to locate. Have them keep a log of their search strategy and of the problems and frustrations they encounter. Then have them discuss their experiences in class in small, informal groups. They can talk about the problems they encountered and their opinions about the search engines they used. Sharing experiences can bring to light ways in which to facilitate using the Web as a research tool.

Software Tools

We believe that graduate students must demonstrate competency in the use of spreadsheets and presentation graphics packages. We require our students to use PowerPoint when presenting their research on the Technology Watch. They are given a very short (five to ten minutes) demonstration of the software after which they learn to use the package on their own. Most of them are surprised at how easy it is for them to learn to use the software. Learning the software on their own gives those students who are intimidated by the world of computers a growing sense of self confidence in their ability to teach themselves different software packages.

This is further reinforced when students are assigned a textbook which guides them through the use of a spreadsheet. At the very last class session, students are required to demonstrate spreadsheet competency. They are asked to create a spreadsheet that will be useful either at work or at home. Using this spreadsheet, they prepare a demonstration that includes switching between value and formula versions, analyzing spreadsheet data by the use of goal seeking, explaining the difference between absolute and relative cell addressing, and demonstrating the use of a variety of functions.

This assignment permits students to be creative. As one student remarked, "I created a spreadsheet for a project at work that impressed my boss so much that I was promoted. While I had a basic idea of how to use spreadsheets, this assignment forced me to spend the time on developing my skills and relating it to the workplace."

Learning and Evaluation Log

Students are asked periodically to write a short paper reflecting on class presentations, group discussions and assignments. The purpose of this Learning and Evaluation Log is threefold: to encourage students to relate their class experiences to the workplace, to participate in the course design by constantly evaluating assignments and group work, and to develop written communication skills.

Students participate in the design of the course by evaluating specific assignments. Students are encouraged to become creative, strategic learners. Based on student feedback and changing IT, the design for the core IS course is constantly evolving.

Students' comments demonstrate that course objectives have been met. For example, one student commented on being an active learner, "It was not like any course I had ever taken because you could not sit back and just listen, take a test or do a paper; you had to get involved." Another said, "The technology watch presentations left me hungry for more information on what makes systems successes or failures."

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STATUS OF MASTER'S DEGREE PROGRAMS IN INFORMATION SYSTEMS

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This paper describes the status of master's degree programs in information systems. An abstracted graduate model curriculum is also presented. Degree programs and course titles from more than fifty graduate information systems programs of universities and colleges were evaluated before a preliminary model was suggested. The model will be useful for academic executives and practitioners of information systems interested in bench marking MS programs in colleges and universities, and for academic heads interested in introducing a new Information Systems program. Information Systems faculty introducing new courses will also find the model useful.

INTRODUCTION

The purpose of this report is to summarize the status of MS degree programs in Information Systems in the United States and to abstract a model curriculum. The ACM comprehensive curriculum recommendations for graduate programs in information systems were presented in reports of Ashenhurst (1972), and Nunamaker et al. (1982). The 1982 report described two master's degree program models: MBA and MS programs. Most schools use the MS as an "in-depth" degree as opposed to the "breadth" emphasis in the MBA. Many colleges and universities offer a graduate degree in Information Systems today. Several more are in the various stages of introducing a new one at present. Unfortunately, the last model curriculum recommendations for the graduate degree program in Information Systems was Nunamaker, et al (1982), fifteen years ago.

SCOPE

Only master's degree programs offering a major in Information Systems and located in the United States were considered. The MBA program is a fairly broad degree and envisions only limited specialization. Therefore, MBA programs and programs that offered a minor in Information Systems (IS) were not included in this study because they envision only limited specialization in Information Systems.

REVIEW OF THE 1982 IS CURRICULUM REPORT

The curriculum report (Nunamaker et al. 1982) describes the uniqueness of the IS curriculum, general prerequisites, degree programs and implementation.

The MS program with a major in Information Systems includes the AACSB common body of business knowledge and ten recommended Information Systems courses to prepare a student to become a systems designer. The MS program model provides sufficient time to develop an "in-depth" major with ten courses in IS.

The 1982 MS degree model program include the following prerequisites and course requirements:

General Prerequisites:
(a) finite mathematics, (b) elementary statistics, (c) elementary computer programming, (d) elementary economics, and elementary psychology.

Specific Prerequisites:
Computer programming and quantitative methods
AACSB Common Body of Knowledge

IS Technology Courses:
IS1 Computer concepts and Software Systems
IS2 Program, Data, and File Structures
IS4 Database Management Systems
IS6 Data Communications systems and Networks
IS7 Modeling and Decision systems

IS Concepts in Organizations
IS3 Information Systems in Organizations
IS5 Information Analysis
IS8 Systems Design Process
IS9 Information Systems Policy
IS10 Information Systems Projects

WHERE ARE WE AT THE MS LEVEL?

To recap at the MS level, the basic curriculum has been ACM's 1982 curriculum. While the ACM outline is still a useful reference what is in each course has changed drastically. Paul Gray addressed this issue at a recent conference (Gray, 1996). The external job market has changed—from people principally going to work in large mainframe shops inside companies to in-house IS, outsourced IS, software packages and system integrators. New technology has appeared, end-user, client/server, WWW, data warehouses, and more. New concepts have appeared or have become important: competitive and strategic use of IS, project management and teams. Some MS programs have become more technical while others are interested in change agent roles or the economics of computing. Organizations today continue to invest heavily in information technology and information resources.

In the light of these changes to the IS discipline, and the release of a revised AACSB standards for business accreditation (1994), the MS curriculum in IS needs to be revisited again. In this context, the IS curriculum research is introduced next.

USERS OF THE MS IS MODEL

The following stakeholders will find a graduate model curriculum in Information Systems useful.

- Academic executives of information systems interested in bench marking MS program with other colleges and universities.
- Academic heads of units where information systems programs are housed.
- Faculty interested in introducing a new Information Systems program.
- Information Systems faculty introducing new courses.
- Information systems practitioners.
- Information systems students.

EXIT OBJECTIVES FOR GRADUATES

It is valuable to define some exit objectives for graduates obtaining a Masters in Information Systems. Exit characteristics of information systems graduates have been identified in other studies (Ashenhurst 1972, Couger 1973, Nunamaker et al. 1982, Davis, Gorgone et al. 1997). The MS IS students should have hands-on experience in various aspects of software design and implementation, and comprehensive knowledge about the state-of-the-art in information technology. Note that many reports and surveys from the industry reveal that the business world today wants graduates with good technical skills (Lee et al. 1995, Maglitta 1995). The Master of Science in Information Systems programs should be able to produce graduates that meet the following IS needs of the business world:

- Broad business perspective, and business experience/skills
- Systems/IS skills, including hardware and software programming skills

- Communication/interpersonal/ team skills
- Analytical and thinking skills
- Real world experience/internship
- Cutting-edge technology knowledge and tools

Additionally, it is our expectation that students with an MS in IS degree program should be able to assist an organization deal with major information systems challenges such as assessing the information needs at different organizational levels within an organization, designing or fully participating in designing systems for an organization, creating an information systems architecture that aligns with the organization's goals and mission, and ultimately designing systems that people can control, understand, and use in a responsible manner.

Finally, Davis (1992) identifies the following four areas of competence for IS graduates:

- Recognize opportunities for use of information technology in business products, services, and processes.
- Interact effectively with the information infrastructure of an organization.
- Access and use information resources in his or her work.
- Select and use appropriate software.

RESEARCH METHODOLOGY

Our research methodology was to review all available Information Systems Curriculum in the United States that clearly offered a Masters in Information Systems. This study did not consider programs that offered only a minor in Information Systems. MBA programs consequently were not considered. The following sources were used to identify programs: Peterson's Guide to Graduate Programs in Business, Education, Health and Law (1996), Directory of MIS Faculty (1995), and the World Wide Web. The next set of tasks for the project included: The collection of college and university catalogs, brochures, general descriptions of information systems programs, and the classification of the programs with respect to a variety of attributes described below.

Each program was evaluated for the following general attributes:

- Where it is housed
- Degree name offered
- Number of semester hours
- Undergraduate pre-requisite degree required
- GMAT, GRE or GPA expectations if any.
- Prerequisite courses in the program
- Core courses in the program
- Additional courses often taught in the program

The IS '97 Information Systems curriculum coding scheme for course titles was used to classify the courses (Davis, Gorgone et al. 1997). This category is listed in Table 1: Coding Scheme.

TABLE 1

CODING SCHEME

Course Code	Course Title
IS97.PO	Knowledge Work Software Took Kit
IS97.01	Fundamentals of Information Systems
IS97.02	Personal Productivity with IS Technology
IS97.03	Information Systems Theory and Practice
IS97.04	Information Technology Hardware and Software
IS97.05	Programming, Data, File and Object Structures
IS97.06	Networks and Telecommunications
IS97.07	Analysis and Logical Design of an IS
IS97.08	Physical Design and Implementation with DBMS
IS97.09	Physical Design and Implementation with Programming Environments
IS97.10	Project Management and Practice

RESEARCH RESULTS

The search initially identified 170 schools that offered IS type programs. One hundred and twenty-four programs were identified as MBA programs or programs that offered a minor in IS and were eliminated from the study. The remaining, fifty-six programs were clearly identified as having a specialized masters degree in IS. Five colleges and universities had two distinct IS programs. For example, the MS CIS and the MS MIS were offered by the same institution. Therefore, in all, fifty-one universities or colleges were studied. Table 2 lists all the 51

TABLE 2
COLLEGES WITH IS PROGRAMS

Baruch College
Baylor University
Bentley College
Boson University
Brooklyn College
Cal Polytechnic Sate U. San Luis
Cal State Sacramento
Case Western Reserve
Claremont
Colorado State University
De Paul University
Easter Michigan University
Friends University
George Mason Univ.
Georgia Sate Univ.
Golden Gate
Hawaii Pacific University
Illinois Benedictine Col.
John Hopkins
Kean College
Marywood
Middle Tennessee State
Northern Illinois University
Nova Southeastern
Pace
Penn State Harrisburg
Regis University
Roosevelt
Sangamon St. University
Seattle Pacific University
Southern Illinois
Stern/NYU
Stevens
Strayer College
Texas A & M
Texas A & M International U.
U Virginia
U Illinois/ Chicago
U Miami
U Missouri, St. Louis
U of Wisconsin at Madison
U of Wisconsin at Whitewater
U. Arizona
U. Detroit mercy
U. of Colorado at Denver
U. Of Maryland Univ. College
U. of South Florida
U. Pittsburgh
West Coast University
West Paul Stillman
Western New England College

colleges and universities that were identified as having the 57 specialized masters in IS.

Where are the IS Degrees Housed?

Fifty-one percent of the master's in information systems programs are located in a business school. Forty-nine percent of the programs are located in other colleges such as arts and science, or in a stand-alone computing college. The IS programs that are located within a business school typically need to meet the accreditation standards of AACSB.

What Are the Different Degree Names for Information Systems?

Not unexpectedly, many different labels were used as a synonym for information systems programs. A sampling and count of the labels is presented The top three frequently used names were MS IS, MS MIS and MIS CIS. Interestingly, the remaining ten IS programs each had a unique name for its program, for example: MS Business Computer Information Systems, MS Management System Analysis, MS Management Studies, and MS Information Systems Management.

TABLE 3
SAMPLE DEGREE NAMES OFFERED

Degree Names	Frequency
MS IS	20
MS MIS	18
MS CIS	9
Unique Names	10

What Is the Frequency Distribution of IS Courses by IS'97 Code?

One of the primary goals of the research was to identify the common courses being taught within a IS program at the masters level. The frequency distribution of IS courses is presented in Figure 1. The graph summarizes the courses analyzed using the IS'97 code. The numbers 11 through 27 represents optional courses that are taught in the core. The list of optional courses is described in Table 4. The designation "O" represents optional courses. In the suggested model (see Figure 2) they represent electives. As expected the electives range in variety, the most popular electives appear to be Accounting and Financial Information Systems, Policy, Thesis/Research, Operation Systems and Management of Computing Resources, Internship, and Organization Communication, Management & Leadership. Electives are frequently used to define an unique character to the IS program.

The percentages indicated in Figure 2 for the most frequently identified courses being taught is probably understated because the study only included the required courses (core courses) in the count. The following two examples illustrate why the frequency count is probably understated:

- If a course was offered as a prerequisite, it was not included in the count even though it was taught in the program. For example, IS97.07 Analysis and Logical Design course was found to be required in 82% of the programs in the core. In many instances this course was a prerequisite to the program when it was not found in the core.
- If a course was offered as an elective, it was not included in the count even though it was taught in the program as an optional course. For example, IS97.06 Networks and Telecommunications course was found to be required in only 52% of the programs in the core. In many instances this course was offered as an elective in the program.

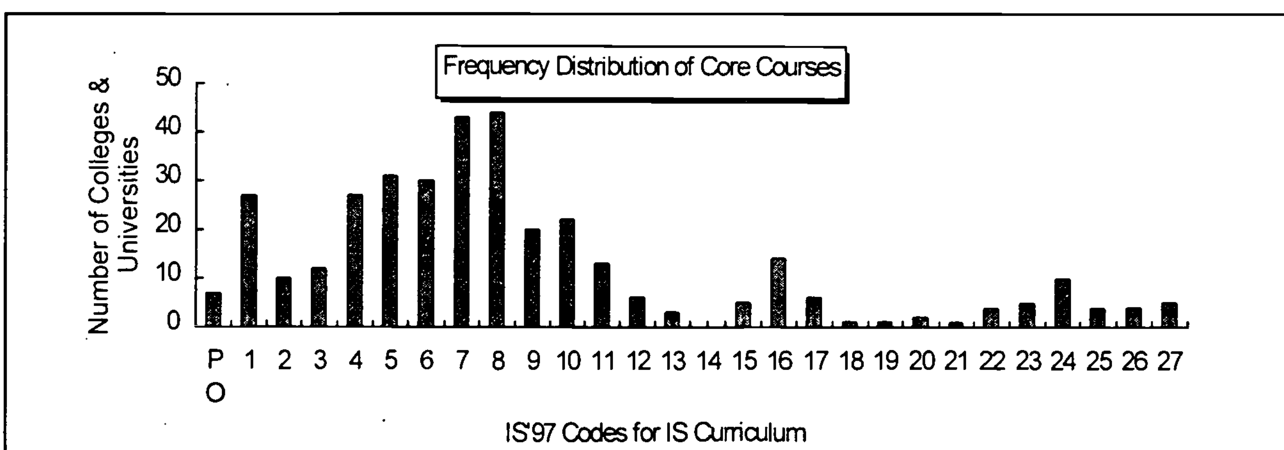
TABLE 4

LISTING OF OPTIONAL COURSES

Course Code	Course Title
O.11	Information Technology and Organization Strategy
O.12	Organization Management and Evaluation of Information Resources
O.13	Technology & Development of Client/Server Systems
O.14	Control, Audit and Security of Information Systems
O.15	Knowledge-Based Systems and Methods
O.16	Collaborative Work, Decision Support and Executive Support Systems
O.17	Human-Computer Interaction and Interface Design
O.18	Simulation Methods and Systems
O.19	Advanced Software and Hardware Architectures
O.20	Alternative Development Methods and Methodologies
O.21	IS Professionalism and Ethics
O.22	Accounting and Financial Information Systems
O.23	Policy
O.24	Thesis/Research
O.25	Operation Systems and Management of Computing Resources
O.26	Internship
O.27	Organization Communication, Management & Leadership

FIGURE 1

FREQUENCY DISTRIBUTION GRAPH OF IS COURSES



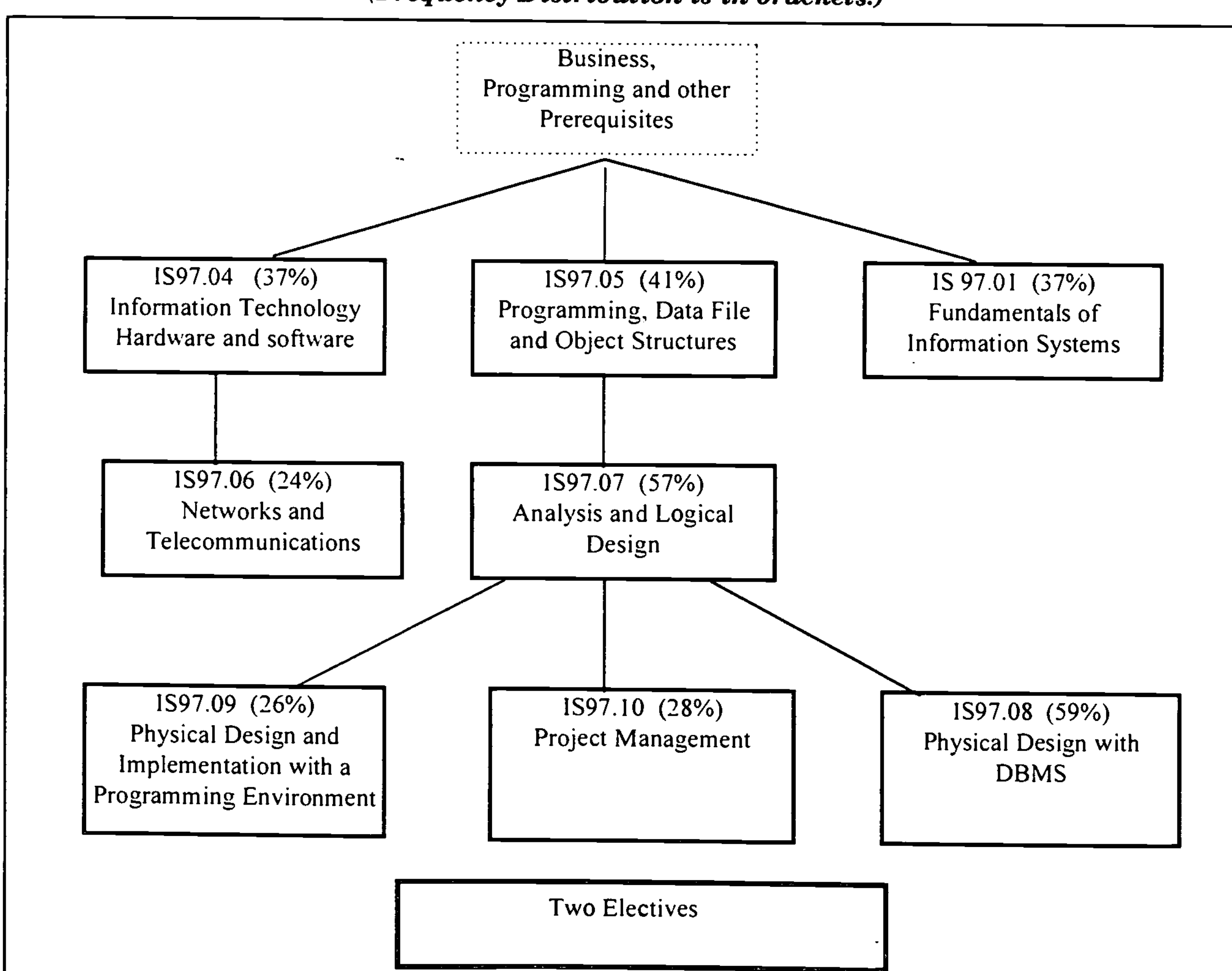
PROPOSED GRADUATE CURRICULUM MODEL FOR MS IS PROGRAMS

The study has abstracted eight core courses that are commonly used by MS IS programs. They are:
The study has abstracted eight core courses that are commonly used by MS IS programs. They are:

- IS97.01 Fundamentals of Information Systems
- IS97.04 Information Technology Hardware and Software
- IS97.05 Programming, Data, File and Object Structures
- IS97.06 Networks and Telecommunications
- IS97.07 Analysis and Logical Design
- IS97.08 Physical Design and Implementation with DBMS
- IS97.09 Physical Design and Implementation with Programming Environments
- IS97.10 Project Management and Practice

In combination with two suggested electives from Table 4, a thirty semester credit framework is proposed. See Figure 2 for the entire model and the sequence of course. The model aligns well with the exit characteristics of graduates for IS programs described early on. The proposed model should satisfy the specialized masters degree program requirements of the AACSB standard (1994). According to the current standard each specialized master's program should require a minimum of 30 semester hours, of which at least 12 hours should be in the area of specialization.

FIGURE 2
SUGGESTED MODEL FOR IS CORE.
(Frequency Distribution is in brackets.)



COMPARISON WITH UNDERGRADUATE IS CURRICULUM

Table 1 lists the courses for the new undergraduate degree model curriculum in Information Systems Davis, Gorgone et al. 1997). Figure 2 lists the proposed graduate degree model. The undergraduate version of the IS program contains ten required courses in addition to the Knowledge Work Software Took Kit prerequisite. The proposed graduate program requires eight courses and two electives in addition to a variety of prerequisites. The two courses omitted from the graduate program are IS97.2 (Personal Productivity with IS Technology) and IS97.3 (Information Systems Theory and Practice). In addition to deletion of these two courses, the contents of six courses are modified for the graduate program. Contents of the other two courses are the same for both degree programs: IS97.4 (Information Technology Hardware and Software) and IS97.5 (Programming, Data File and Object Structures). IS97.1 (Fundamentals of Information Systems) at the graduate level combines material with IS97.2 (Personal Productivity with IS Technology). The prerequisites are different for both programs. For the courses common to both programs the principal differences in the graduate and undergraduate courses are the time spent on each topic, and level of instruction.

CONCLUSION

This research has described the status of master's degree programs in information systems. Fifty-six programs in fifty-one colleges and universities were identified as offering a specialized master's program. The study found where the degrees where housed, the different names used by the programs, and determined the common core courses offered by these programs. This paper has proposed a common model curriculum for current MS IS degree programs and has described exiting objectives for graduates. The next step in the process is to prepare a curriculum model that would provide guidelines for future curriculum direction for MS IS programs.

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A STUDY ON TRAINING, TECHNICAL SUPPORT, CONTROL AND THEIR EFFECT ON EUC SUCCESS

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The last few years have witnessed continuous power shifts in the information structure of organizations. As a result of theses changes, end-user computing (EUC) has been growing at a tremendous rate. This paper extensively discusses the three functions of Information Centers (IC) to support EUC in organizations: training, technical support, and control. A study was performed to seek the relationship between the three functions and EUC success. The results of the study indicate that ICs' ability to effectively deliver support to end-users significantly affects the user satisfaction and that providing the types of support end-users prefer will result in a higher satisfaction level. The contribution to practitioners and researhers are also discussed.

INTRODUCTION

The last few years have witnessed continuous power shifts in the information structure of organizations, for example, the shift from mainframe systems to the powerful PC networks (Udo & Kick, 1994), the shift from plain DOS-based software to user-friendly, function-rich, and integrated software suites with GUI, and the loss of IS departments' monopolistic power in information processing to end-users. As a result of these phenomena, end-user computing (EUC) has been growing at a tremendous rate. It was estimated to grow at 50 to 90 percent every year (Cronan & Douglas, 1990) and was recognized among the most important information systems issues by both academicians and practitioners (Caudle & Corr, 1991). Previous studies have suggested that EUC has several advantages over the traditional IS department domination approach including shortening lead time for system development, giving users more control and flexibility in information they need, and lowering the organization's cost for information processing (Leitheiser & Wethebre, 1986a); however, improper management of EUC can lead to disastrous consequences (Davis, 1984). Therefore, many studies have been conducted with respect to the managerial issues of EUC in attempts to provide the information centers (ICs) with greater insights into how to achieve the organization's goals through better management of EUC.

One of the most important deliverables of an IC in the organization is EUC (Jones, 1996). It is well acknowledged that end-user support and control are the two fundamental managerial issues in EUC, and they were proposed by Alavi et al. (1988) as the two primary activities which determined how EUC contributed to the overall success of the organization. Mirani and King (1994) defined support as "the provision of various kinds of assistance to users in their computing activities" and control as "seeking to provide limits, rules, and regulations for such activities".

End-user support provided by ICs, which basically consists of end-user training and technical support, proves to be the best means of ensuring the success of EUC by enhancing the development and growth of EUC in the organization, and it is critical to user satisfaction and EUC effectiveness (Mirani & King, 1994; Alavi et al., 1988; Compeau et al., 1995; Garavan & McCracken, 1993). The growth of EUC is giving rise to increasing demand on ICs for more support (Forgionne & Willits, 1987). Due to their different nature and domain, training and technical support are often discussed separately.

End-user training entails activities such as conducting formal teaching on specific EUC topics, and it is usually achieved in a classroom environment. As a study has found that users normally spend 4 of every 12 computer hours trying to learn how the system works (Radding, 1989), training becomes an imperative EUC management activity to promote more effective and efficient use of computers. Regan & O'Connor (1994) stated that ICs' understanding of the underlying educational philosophy, including behavior approach and cognitive approach, proved to be helpful in tailoring the training programs to fit different end-users and training topics.

Unlike training, technical support is an ad hoc support activity which is conducted when end-users encounter EUC problems. Responsiveness of ICs to user problems is ranked high among major end-user concerns (Rifkin, 1986), therefore, adequate technical support resources must be allocated to ensure user satisfaction and smooth operation. End-user training is time consuming and costly, but it provides lasting impact on users' ability to effectively and efficiently use the EUC tools. Technical support has the advantages of saving resources (eg. time and money) and targeting the problems directly, it does little in helping users have thorough understanding of the solutions and ensuring fault-free operation later on.

As a by-product of the distribution of information processing power of EUC, control has received a great deal of research attention. Literature on the control mechanisms including policies of hardware/software acquisition (Mclean & Kappelman, 1993; Montazemi et al., 1996; Munro and Huff, 1988; Lewis, 1996), security (Fink, 1995; Nord & Nord, 1994), backup (Garcean & Pozanski, 1995), testing and documentation (Cale, 1994; Lewis, 1996), and ethics (Spiro, 1989) have emphasized the importance of imposing sufficient control in order to shape the growth of EUC. However, it has also been uncovered that as the level of control increases, user satisfaction tends to decrease (Bergeron & Berube, 1990). Despite its importance, few organizations have impelemented comprehensive procedures to ensure adequate control (Rittenbery, 1993).

Control involves developing and implementing policies regarding hardware/software acquisition, security, testing and documentation, and ethics, and if used well, these policies are expected to lead to a more effective partnership between end-users and ICs (Montazemi et al., 1996). Such partnership is believed to "better utilize information resources to meet organizational objectives, overcome these human, political problem and facilitate resolving many of the technical ones as well" (Kappelman, 1995, pp.36). Although control was found to have a negative relationship with user satisfaction, it serves as an important stabilizer for today's extremely dynamic EUC growth, thus the lack of it will put EUC growth at risk.

Providing adequate training and support along with developing policies for control are factors consistently related to the success of EUC (Rittenberg & Senn, 1993), therefore managing these activities should be raisen to the top priority of ICs. End-users being the internal customers to ICs (Jones, 1996), providing satisfying EUC helps improve their productivity, operational efficiency, decision making capabilities, and quality of work life (Khan, 1992). To ensure that the activities of support and control are managed effectively, it is crucial for ICs to understand the importance of their responsibilities and be able to prioritize their activities in order to design the most appropriate EUC management solution with the resources available.

ICs have always found themselves struggling under the pressure from both end-users who ask for more support and the management who demands more control. Many studies have been dedicated to seeking the equilibrium between the control and support (Munro & Huff, 1988; Saarinen et al., 1988; Metz, 1988; Leitheiser & Wetherbe, 1986b; Gerrity & Rockart, 1986). Among them, Saarinen et al.'s (1988) study classified EUC management alternatives into four levels: laissez-faire, containment, expansionist, and controlled growth and found the last two approaches accelerated the growth of EUC to reach an advanced state faster than the first two. Study conducted by Leitheiser and Wetherbe (1986) revealed that effective service delivery of ICs was of increasing importance to users.

A number of recent studies suggested that the importance of ICs in EUC success was overemphasized. Bowman et al.'s (1993) study found ICs the least preferred source of support among all studied which were other users, vendor manuals, purchased books, and program help screens. The reason for such understatement is due to the poor performance of ICs in many organizations, and it should not discount the importance of ICs in achieving EUC success. Rittenbery and Senn (1993) identified the following 5 factors to be consistently associated with successful EUC:

1. EUC responsibilities have been defined and policies have been developed (Control).
2. Effective information centers have been established to support EUC needs (Support).
3. Mechanisms to share and protect data have been developed and are functioning (Control).
4. End-users are being trained and educated (Training).
5. End-user developments have received appropriate allocations.

Four out of 5 of these factors involve ICs' ability to provide control, support, and training while the other one deal with the information infrastructure and resource allocation. Guimaraes and Igbaria (1994) discovered that ICs' performance directly affected the benefits the organization has gained from EUC activities and the overall business performance. Therefore, the importance of ICs in achieving EUC success cannot be underestimated.

Delone and McLean (1992) identified three reasons why user satisfaction had always been widely used as the single measure of IS success, and they are 1) high degree of face validity, 2) reliable tools for measure have been developed, 3) conceptual weakness and unavailability of other measures. Therefore, this study employs user satisfaction to represent an important aspect of EUC success. This rationale leads to my first hypothesis:

Hypothesis 1: Training, technical support, and control provided by ICs are statistically significant discriminators for user satisfaction.

White and Christy's (1987) normative model assumes that ICs should provide methods for improving EUC effectiveness and efficiency in order to accomplish their mission, and their study found most ICs deficient in doing so. This study hopes to find out whether training, technical support, and control provided by IC are statistically significant discriminators for EUC effectiveness and efficiency, and if so, what is the order of priority among these activities. In this study, EUC effectiveness is defined as assisting end-users to make better business decisions, and EUC efficiency as saving end-users time and effort in work.

Hypothesis 2: Training, technical support, and control provided by ICs are statistically significant discriminators for EUC effectiveness.

Hypothesis 3: Training, technical support, and control provided by ICs are statistically significant discriminators for EUC efficiency.

In their study, Ford et al. (1996) acknowledged that demographic factors, prior computer training and experience had significant impacts on the participant's use of computers. Due to the different nature and impact of end-user training, technical support, and control, ICs need to understand different users' preference for these EUC management activities in order to manage EUC more effectively. Rivard (1987) discovered that support provided to end-users had the highest correlation with user satisfaction among the six factors that contribute to user satisfaction. I expect that higher user satisfaction should occur when ICs provide the kind of support preferred by end-users. To examine the correctness of this assumption, the following hypothesis will be tested.

Hypothesis 4: User satisfaction varies significantly with ICs' fulfillment of user preference of EUC management activities including training,technical support, and control.

METHODOLOGY

A questionnaire was designed in the attempt to capture the data needed in the studies. The first section of the questionnaire consists of inquiries on end-users' self-reporting satisfaction level, whether the implementation of EUC increases or decreases their efficiency at work and effectiveness in decision making, and the adequacy level of end-user training programs, technical support, and policies of provided by ICs in the surveyed organizations. Three groups for every dependent variable are identified and shown in the following table.

TABLE 1
Groups for User Satisfaction, EUC Effectiveness, and EUC Efficiency

	Group 1	Group 2	Group 3
User Satisfaction	Not Satisfied	Neutral	Satisfied
EUC Effectiveness	Not Effectice	Neutral	Effective
EUC Efficiency	Not Efficient	Neutral	Efficient

Although multiple attribute instruments to measure user satisfaction have been developed and are widely used (Doll et al., 1994), this study uses a single overall satisfaction rating. This approach was also used in other studies such as that of Edmundson and Jeffery (1984), Hogue (1987), and Langle et al. (1984) (Delone & McLean, 1992). It is valid because the concepts in this study such as training, technical support, and control are all studied in a general sense, therefore, a measure of overall user satisfaction rating should be employed. Single overall effectiveness rating and efficiency rating are employed for the same reason as user satisfaction.

The second section of the questionnaire is devised to find out an end-user's most preferred EUC management activity. The variable will be analyzed in conjunction with some variables in section one. If the organization fulfills the user's preference by providing adequate level of her preferred EUC management activity, then a fulfillment score of 1 will be assigned. Similarly, fulfillment score of 0 or -1 will be assigned if the organization provides less than adequate or none of her preferred EUC management activities, respectively.

The questionnaire was distributed to employees in two metropolitan areas. The main criteria in choosing the samples was that the respondent must be a full-time employee at an organization which implements substantial degree of EUC, thus all the responses were guaranteed to render valid data for this study. Among all the returned questionnaires, 48 were found to be complete and usable.

SUMMARY OF RESULTS

Fisher's linear discriminant analysis was performed to test the first set of the hypotheses, which is to find out whether the adequacy level of training, technical support, and control provided by IC significantly discriminate the outcomes of the organization's EUC effort including user satisfaction, effectiveness in decision making, and efficiency in operation. Statistical result shows that user satisfaction levels are significantly discriminated by these three factors. The Wilks' Lambda and Chi Square are calculated to be 0.51 and 29.39, respectively, and the significance is 0.00. The classification functions are displayed in Table 2. The result supports hypothesis 1, which predicts that the adequacy level of training, technical support, and control provided by IC are able to discriminate user groups with different satisfaction levels.

TABLE 2
CLASSIFICATION FUNCTION COEFFICIENTS

	Group 1: Not Satisfied	*Group 2: Neutral*	*Group 3: Satisfied*
Training	3.06	3.61	6.47
Technical Support	3.10	3.97	4.76
Control	0.36	0.15	-0.67
(Constant)	-7.51	-9.48	-15.42

TABLE 3
STANDARDIZED CANONICAL DISCRIMINANT FUNCTION COEFFICIENTS

	Training	*Technical Support*	*Control*
Coefficient	0.94	0.41	-0.36

Table 3 displays the standardized canonical discriminant function coefficients derived from the discriminant analysis. Among the three variables, training has the highest coefficient which indicates that the adequacy level of training is the most important element in predicting user satisfaction level. The negative coefficient of the adequacy level of control suggests that as ICs increases their control over EUC, users tend to fall into groups with lower satisfaction levels. This finding is consistent with the previous studies which discovered the negative correlation between EUC control and user satisfaction.

TABLE 4
CLASSIFICATION RESULTS

	Predicted				
Observed	Not Satisfied	Neutral	Satisfied	Total	% Correct
Not Satisfied	4 (50%)	3 (37.5%)	1 (12.5%)	8	
Neutral	3 (25%)	6 (50%)	3 (25%0	12	
Satisfied	1 (3.6%)	1 (3.6%)	26 (92.9%)	28	75%

Table 4 presents the classification results corresponding to the classification functions in Table 2. The classification functions perform better than a random proportional chance model, which would have a hit rate of (n1p1 + n2p2 + n3p3) / (n1 + n2 + n3), where p is the probability of belonging to a group, and n is the number of samples in each group. Based on the prior distribution of the samples, I estimated p1, p2, and p3 to be 0.17 (8/48), 0.25 (12/48), and 0.58 (28/48), respectively. Thus the hit rate from a random proportional chance model is 42.9%. The rate of correct classification using the classification functions obtained from the discriminant analysis is 75%, which is significantly higher than that from the random model.

The three variables are not found to be the significant discriminators for user groups with different efficiency and effectiveness levels, therefore, both hypothesis 2 and 3 are not supported by the statistical result. However, only 2 users claimed to have inefficient outcomes from using EUC while 42 claimed the opposite, thus the insignificant finding may be the result of the extremely unbalanced distribution of the samples among the groups.

The fulfillment scores and user satisfaction level are tested using correlation technique. The Spearman coefficient was 0.62 with a significance of less than 0.01, therefore, a positive correlation between fulfillment score and user satisfaction exists. This result supported hypothesis 4 which stated that an end-user is likely to have higher satisfaction level if the IC provides the EUC management activity that she prefers.

IMPLICATION OF THE STUDY

The relationship between EUC success and EUC management is the issue studied in this study. It was found that end-user training, technical support, and control significantly affect user satisfaction level. Among these three EUC management activities, training plays the most important role in ensuring user satisfaction. Technical support is another important means for ICs to increase user satisfaction. However, control is found to have a negative relationship with user satisfaction, therefore, it should be used with great caution. While most IS professionals have realized the importance of imposing adequate control to ensure the security and healthy growth of EUC, they should also understand that end-users' attitude towards control is often different from theirs. Based on this finding, the study went into detail to seek the relationship between the fulfillment of an end-user's preferred EUC management activity and her satisfaction level. It was discovered that an end-user is likely to have higher satisfaction if the IC provides the EUC management activity that she prefers. This finding has some important implication to ICs in predicting the outcome of their EUC management activities.

The findings of this study can be used as guidelines for ICs in designing their portfolio of EUC management activities in their organizations. Different priority should be assigned to every activity to amplify the returns to the investment in EUC within the limited budget. The findings also imply that ICs should form a close relationship with the end-user community and provide channels for communication, since the understanding of end-users' attitude and preference of EUC management activities can serve as an critical success factor for ICs. Instead of providing homogeneous support to all the end-users, ICs should carefully evaluate the user profiles and apply appropriate support to users with different characteristics. EUC being the dominant direction of information processing in organizations, the success of it will tremendously escalate the organization's competitiveness in the global market.

Due to the recent corporate downsizing, many companies are outsourcing their support efforts. A survey done by Computer Sciences Corp. In

1994 indicated that 61% of the North American firms would outsource their training and support activities (Kiss, 1994). Understanding the influencing factors in providing satisfying end-user support becomes a imperative competence for vendors specializing in these services to compete in this growing market.

LIMITATIONS AND FUTURE RESEARCH

The primary limitation of this study is the small number of observations. The sample size used in analysis is 48. This gives rise to the unbalanced distribution of observations among the three groups. The result of the analysis inevitably suffered from this limitation.

An important dimension omitted in this study is the variation within every EUC management activities discussed here. End-user training, technical support, and control all provide a wide variety of choices within themselves. Training can be conducted with behavior approach, which emphasizes drill and practice, or with cognitive approach, which encourages the study of mental processes such as remembering and problem solving (Regan & O'Connor, 1994); technical support can be provided through a number of media including telephone, which has the lasting advantage of responsiveness and directness, recently emerged electronic support using E-mail and World Wide Web, on-line help, and etc. (Piquet, 1996); Control also covers a wide range of issues including hardware/software acquisition, security, and ethics. I realize that different choices within the three activities may render different outcomes of EUC. A possible arena for future research is to classify EUC management activities into finer subcategories and further investigate the effects that these subcategories have on EUC result.

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TOWARD CREATING A GENERATION OF NON -THINKERS A CONTRARY VIEW ON CYBERSPACE AND TECHNOLOGY

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EXTENDED ABSTRACT

When the PC's hit the mainstream in roughly 1982, virtually everyone was caught by surprise. At first, no one really knew what to do with the things, except of course the "techies". Their interest was to continue building more complex and more powerful machines. The rest of us were faced with the task of learning how to turn the things on and deciphering the seemingly foreign language referred to as DOS. Gradually, as we all know by now, significant uses and meaningful results in terms of better information and (in theory) better decisions were made. The computer and it's applications have since become an integral part of business, education and most recently, via the Internet, our personal lives.

Eventually the PC contained as much computing power as it's mainframe ancestors. In addition to automating routine manual functions, the manufacturers added multimedia capabilities, namely - graphics, animation, video, sound and to some extent interactivity. The computer was beginning to emulate a cross between a game room and television. And most recently, of course the World Wide Web as accessed via the Internet is adding an entirely new dimension to computing - legitimizing the wasting of time, while on the payroll.

The recent addition to the technology landscape of the likes of America-On Line, Mosaic, NetScape, MSNBC, TalkBack Live etc,etc; the fact that Homepages are being produced at a record pace and the Web is being accessed to the point of an electronic break-down , and the fact that the school systems are embracing the new technology would seem to indicate that we are indeed approaching technological nirvana. After all everybody is talking about it , manufacturers are selling tons of multimedia and Internet stuff and the media is certainly jumping on the bandwagon.

Actually, the Internet is in it's infancy. The WWW that we see today will be nothing like it will be in the future. It is just a matter of time before the computer, the telephone and the television are linked together. When that happens, our televisions will essentially become our computers. Conceivably a person could complete an entire course, and possibly an entire degree program with virtual instruction without leaving the house.

The direction in which we are heading must be on target - we are on the verge of harnessing the technology to make a better life for ourselves. Isn't that where we are headed? Isn't that what we are being told? Let's face it , anyone voicing a contrary opinion would certainly be viewed as a technological inferior and perhaps worse - a cyber dope.

As the technology and computer revolution continues at a frenetic pace, perhaps it is time to stop, if only for a moment and raise a few questions. Questions that need to be asked, although that may appear to be old fashioned thinking, techno-phobic, even uninformed or even worse not cool or even worse than that - cyberdopic (a new cyber word, I think).

For instance, are we in the process of creating a generation of non- readers? Will it be necessary in the future to read anything more than a brief synopsis/description of a video and sound production on a subject ? - something similar, let's say to an encyclopedia on a CD-ROM- pretty much

the bare minimum of written material but great sound and video. Will there even be a need to become an effective reader? Will we become audio/visual learners, not unlike Sesame Street, for example. Will anyone bother to read the good and bad novels? Will the book still be better than the movie? Will there even be a book? If there is, will anybody read it.

According to the results of the 1994 National Assessment of Educational Progress (NAEP), three quarters of all 4th and 8th graders were "unable to read at the level necessary for solid academic performance." Two-thirds of high school seniors were similarly judged to have inadequate reading skills. Interestingly, the study and others like it indicated that the best way to improve reading skills is to read more.

Are we creating a generation of students who can not conduct research, can not investigate a problem? We are reaching the point, through the use of various queries and key word searches on the Internet, that a person, without leaving their workstation, can literally find hundreds and thousands of "hits" of material on a particular subject.

Using various university linked and commercial databases, a person can search libraries throughout the world for selected material. Much of this material can then be electronically sent to the requester's computer or printer. Are we unintentionally stifling creativity? Will we simply be cutting and pasting canned data and picture sets? Why create your own picture when you can search and retrieve an existing picture within a matter of seconds. How much simpler could it be to "cut and paste" a research paper? Is this truly beneficial to the student or would the more traditional research methods be more meaningful.

Libraries, as we know them will eventually disappear The problem, however, is who will decide what books, periodicals, and other material will be accessible on the Internet. Will the researcher be limited to material that has been determined to be worthy of the Internet. Will the researcher be able to find the material that didn't make the cut, that perhaps held a minority viewpoint or a different perspective on the problem? Who will ultimately own the Internet, corporate America, Microsoft?

Are we creating a generation of students that will not need to think critically, to think at all for that matter? Will we reduce this most important exercise to determining what the keywords of a search should be or providing an artificially intelligent computer with selected data and let it make the decision, based of course on the "norm"? Once again, whose "norm" will we be going by?

In an effort to embrace the new technology, educators and parents may be making a fundamental mistake. That mistake being, - should we automatically assume that learning should be entertaining. Should it always be fun? Should it be easy? Should it be the same as playing a video game in a virtual video room? Is the notion that learning should be a challenge, hard work and sometimes difficult no longer a valid argument?

As the technology progresses and as financially pressed school districts look for cost saving options, the solution could very well be to reduce or perhaps even eliminate the highest budget item, the teacher. Some schools are videotaping instruction for later review by the students. Distance learning, of course, relies heavily on technology and certainly, in the long run reduces the cost of operating a school system. As the baby boomers age and their children leave the "cyber" nest, the attraction to reduce property taxes by shifting from a labor intensive to a technology intensive instructional format will be compelling. When is the last time a computer asked for a raise? Will all students be taught using the same format and formula? Will the individual learning needs of students be ignored?

Let's face it, the manufacturers are in business to sell hardware and software. Their fundamental interest is to make money. This is, of course, the way it should be. However as more and more educational "toys" hit the market place, will these same manufacturers concern themselves with incorporating educational principles and objectives into the products or will they be more interested in the entertainment value, the consumer appeal and the resulting sale. Will educators continue to unknowingly embrace these "toys", disguised in such terms as, interactive learning, distance learning, self-paced learning modules?

Perhaps I am sounding like a technophobic teacher in fear of losing my job. Actually the contrary is more like the truth. I am competent and feel very comfortable around computers. I have developed applications using conventional and multimedia software and have created a Homepage on the Internet. While I am a teacher, (Associate-Professor, School of Business, Miami University - Ohio) I am also a Certified Public Accountant (CPA) with 20 years business experience. I have no ax to grind with the computer industry, as a matter of fact, I have taught computer courses.

I have no real data to confirm my suspicions, namely, that we are unwittingly allowing technology to replace that which separates our thought process from the computer - the ability to think. If you think I am off base, conduct a search on the WWW using "neural networks" as the keywords and review some of the articles and discussions that are taking place. Similar "the sky is falling" arguments were made when the radio and then the television appeared on the electronic landscape and when first computers were invented. However, computing in the past allowed us to automate menial tasks, allowed us to search sort and query large amounts of data, allowed us to process words, draw graphs and pictures and play games.

What is different now is that we are allowing , even encouraging technology to think for us, to conduct intellectual exercises in our place. All of this is being done under the headings of technological progress and cyberspace. Who are we kidding, do we honestly believe that when given a choice, a student of the future will chose the written word over sound, video, graphics and animation, a veritable game room? By giving information to a student in a video game format, do we honestly believe that this will promote critical thinking, or foster a desire to further investigate a problem? I don't think so. I think over time we will become very accepting of the information that is made available to us by cyberspace architects and gurus - and who would they be? Hardware and software manufacturers, the political right or left, some techno - geek who is afraid to leave the house?

If we do nothing, the very technology that we thought would hold such promise may prove to be our undoing. We may become a nation of watchers, passive learners, unchallenged by actual instructors, unable to read and think effectively and most importantly totally ignorant of the consequences, until it is too late.

So if there is a problem what should we do about it, can we do anything about it? Obviously, we are not going back to the days of manual processes and Radio Shack TRS-80 computers (remember 64k of RAM!!). The technology, as represented by the hardware and software will continue to progress. Manufacturers will continue to produce new models, new versions and new toys. No one really knows what the limit is. Supply and demand, as it should, will determine the marketplace.

Given that the technology will continue to advance, it will become our responsibility to control, monitor and tame this technology. We can begin this process by assuring that our elementary students continue to receive a solid foundation in Reading, Math, English and Science skills from actual teachers who care about their students. The teaching of critical thinking skills must be a part of the curriculum across the board . Technology should be viewed as a tool to supplement the teaching of basic skills. Technological innovations, new products and the latest bells and whistles should be viewed with a healthy skepticism, in the context of how these tools can help us teach the skills mentioned above. We must fight the tendency to automatically accept and embrace technology.

Most people will tend to place greater credibility on a computer generated document than a handwritten one. We have always been a nation of tinkerers, makers of things, the more complex the better. We are enamored of technology. We have always had a tendency to solve the problem with technology. Obviously, as a nation we have been quite successful. However, we may have reached the point where we are unknowingly allowing technology to become the thinker not the doer.

Finally, in the year 2008, as the father and his junior high students are leaving the cyber theater, after reluctantly agreeing to view " Gone With the Wind", the father says to the children, " I thought the book was much better, the book is always better than the movie". To which the students replied, "What's a book?

STUDENT PERFORMANCE AND DATA BASE DESIGN: THE ROLE OF COGNITIVE STYLE

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EXTENDED ABSTRACT

Analysis and design, and the use of conceptual modeling to facilitate the analysis and design processes, are integral parts of information systems courses. For example, entity-relationship and/or object modeling are taught in database design courses, data flow diagramming is prevalent in systems analysis courses, and structure charts are used in systems design courses. When a conceptual model is developed, one must focus on the critical events of interest (Yourdon (1989) refers to these as the essential model). The analyst must disembed these critical events or objects of interest from those which are not of interest for the system being modeled. The ability to disembed objects from the larger context in which they occur is commonly referred to as field independence (Witkin et al. 1971). Prior research has indicated that individuals who are field independent are likely to outperform field dependent individuals when studying scientific matter (Burkhalter and Shaer, 1985), in electrical fault diagnosis (Moran, 1986), and in computer programming (Bishop-Clark, 1995). This study investigates whether this observed phenomena also occurs in database design.

In this study, 98 undergraduate students completed the Group Embedded Figures Test, a commonly accepted measurement for field dependence (Witkin et al. 1971), and were classified as either field dependent or field independent based upon their performance. Entity-relationship modeling was a significant focus of the class in which they were enrolled, along with the eventual development of a working database using Access. In addition, other topics, such as internal controls, documentation, and technology-related items were covered.

The students spent approximately 50% of the course on conceptual modeling concepts. They completed numerous homework and in-class exercises and were tested on their conceptual modeling skills at two points. The field independent students performed significantly better in conceptual modeling than field dependent students. The students' scores for non-data modeling skills were collected at the same two points as the data modeling scores. There was no difference in performance between groups on the non-data modeling problems. Subsequent analyses indicated that field dependent students performed significantly better on the non-data modeling tasks than on the data modeling tasks, while the field independent students showed no significant difference between these tasks.

These results suggest that educators need to consider the material that is being covered and the impact that it will have on students, in particular on field dependent students. These students can perform equally with field independent students on tasks that do not require the ability to disembed, however, they may be disadvantaged when asked to perform tasks that requires the ability to disembed, such

as in data modeling and systems analysis and design. Further research should examine whether different presentation or feedback techniques can mitigate the difference between how field dependent and field independent students perform.

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A SPIRAL APPROACH TO TEACHING DATABASE AND SYSTEMS DEVELOPMENT: THEORY VS. REALITY

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The Applied Computer Science Department is in the process of implementing a re-engineered curriculum that utilizes an integrated and spiral approach to subject coverage. The 1996-97 school year was the first year that upper division course prerequisites were based on the new curriculum instead of a mixture of old and new. During this first year, the authors taught upper division courses that relied on students having acquired the knowledge and skills from the first portion of the spiral. This paper will focus on these upper division courses and the articulation issues and problems that arose when trying to teach them. These issues and problems will be analyzed, attempted solutions discussed and suggestions offered for those faced with a similar situation. After teaching the two follow-on courses, it was apparent that more planning and development work needs to be done in order to affect a smoother transition along the spiral.

INTRODUCTION

The Information Systems program in Illinois State University's (ISU) Applied Computer Science Department (ACS) has over 500 majors. The Department also houses a Telecommunications program and has recently added a Computer Science component. All of these programs rely on a common core of courses within which material essential to continued study in any of the areas is introduced. The focus of this paper is the systems analysis and design component of the core, including system development tools and database concepts, and the way in which the introduction of this material in a first, core course impacted the more advanced treatment of the topics in advanced courses for Information Systems majors.

Due to the dynamics of technology and the field of Information Systems in general, the department has been involved for many years in curriculum revision. This multi-year effort resulted in a re-engineered curriculum in 1994. The department is currently completing the process of implementing the re-engineered curriculum. Due to catalog commitments to (then) current students we could not simply cut-over to our new curriculum upon its approval. Rather we had to support the previous curriculum for a number of years and phase in the new curriculum for incoming students. As a consequence of this need for dual support, there were a couple of years during which instructors were given some flexibility in their approach to certain courses, so that the particular backgrounds of the enrolled students could be taken into account. In the case of the courses discussed in this paper, students in either the advanced systems analysis and design course or in the upper-division database course may or may not have had a lower-division course, which introduced some of the methods and concepts relevant to database and systems development.

The 1996-97 school year was the first year that upper division course prerequisites were based on the new curriculum instead of a mixture of old and new curricula. The faculty had understood that, due to the phased implementation, the program and the students would not gain the benefits of the re-engineered curriculum until all of the courses in the old curriculum were completely phased out. Thus mismatches in course articulation during this period were expected and did not raise extraordinary concern.

The re-engineered curriculum (1) utilized an integrated and spiral approach in designing subject coverage. The start of the spiral for database and system development has been described in Chrisman, 1996 (2). This school year the authors taught upper division courses that relied on students having acquired the knowledge and skills from the first portion of the spiral.

The spiral approach to subject coverage is based on the idea that knowledge and understanding expands through multiple interconnected levels of understanding. Thus when a student is introduced to new material, it is taught in a context which relates it to other known material at the level at which that material is understood. As a result while various topics will receive a complete contextual treatment the first time they are introduced to the student, they may not receive a topically detailed treatment. The intent of this approach is to provide a framework and understanding prepatory for the time at which the topic will be revisited later in the curriculum.

At the time of the writing of this paper our students are completely within the redesigned curriculum. Consequently, the issues and problems which occur in teaching the upper division courses can not be attributed to the need to support requirements from both the old and the new curricula. This paper will focus on these upper division courses and the issues and problems that arose when trying to teach them. These issues and problems will be analyzed, attempted solutions discussed and suggestions offered for those faced with a similar situation.

PRE-SEMESTER PREPARATION

Under the circumstances, the upper division course in systems development was viewed as if it were a new course. Our previous course in systems analysis and design both introduced systems development tools and methods and required students to carry out the analysis and design of a live project. Additionally it was followed by a course in technical design that had been eliminated in the new curriculum in favor of multiple alternative courses dealing with various technologies and implementation-level issues. Our new upper division course was to rely on most of the modeling methods and concepts as prerequisites. This would allow more time for project management and other project-related issues.

In planning for the course, the instructors of the prerequisite course were consulted, copies of all related course material were reviewed and possible textbooks were obtained. As this information was reviewed, it became obvious that there would be a problem in coordinating and managing the transition to the upper division direct follow-on course. Based on our understanding of the first course's content and coverage of subject matter, a general topic outline for each week of the 300-level system development course was developed. The next step was to find a suitable textbook. Issues in this area of textbook selection encompassed the following items:

1. the need to find a text that covered the topics in the outline at an appropriate level.
2. students' perception of the uniqueness of this particular course.
3. the extent of the overview coverage of the previous course.

After much deliberation, we worked with a publisher to customize a text for the course.

We found that the situation with textbooks presents a unique challenge to using the spiral approach in teaching the courses included in the spiral. Most systems analysis and design textbooks try to provide a complete, linear, treatment of each covered topic, e.g. modeling technique, using a single-pass approach. In our case, the lower division course had, in fact, selected such a text. In some sense the students had already "seen it all", even though they had not been required to read all of the sections of each chapter in the text. One option was to re-use the same text that had been used in the lower-division course. But the challenge would have been to get the student to understand that we were advancing to a new conceptual level. They had used a text that would allow an instructor to completely cover the material at an advanced level (or not). In the end, we decided that to ask the students to use the same text but re-read it with a different perspective would be unwise.

The option of using another standard systems analysis and design text had its drawbacks as well. By definition, such textbooks are very much alike. Perhaps there are pedagogical reasons to select one over another, but we felt that the students would not see it quite that way. We wanted the students to approach the material with a fresh perspective, and not as if it were a rehash of their previous course.

As a consequence of these factors, we tailor-designed a text from multiple sources. We hoped that by tailor-designing the text, it would play the role of a coherent body of material that would supplement the students' previous text. In this way the advanced course could compare methods and approaches and involve the students in a discussion of the relative merits of one approach over another. The students would also have access to a broader resource base while doing their projects.

Review of the text and syllabus for the lower-division course also highlighted another concern. Most current systems analysis and design texts provide "A to Z" coverage of the field. Obviously such a text provides a framework for extensive coverage of a topic but leaves open the possibility that the instructor may have more limited goals. As a result, it is very difficult to determine depth of coverage or expectations by looking at topic or syllabus coverage. By the time of this cut-over, seven different instructors had taught sections of the lower-division course. We were left with a number of problems: Did the textual material identify the maximum extent of actual topic coverage in class or had instructors used this as a framework to relate more advanced material based on their (e.g., consulting) experience? Had classroom discussions pushed some of the instruction to the level of issues expected to be covered in the upper division courses? On top of this how did all of the various instructors deal with these things individually? As a result of these questions, follow-on instructors were caught in the switches trying to identify a good starting/continuation point for the advanced classes as a whole.

One thing that became apparent as we reviewed the situation was the need for close coordination at the sequence level not just at the individual course level. Within the Department, it has been the practice to assign one faculty member teaching a course with multiple sections, the responsibility of being course coordinator. However, in this situation where the intent is to engage in the spiral approach to topic coverage in a sequence of courses, it may be appropriate to also assign a sequence coordinator.

The 300-level database course did not receive the same scrutiny since it was not considered to involve as dependence and overlap with the 200-level course. In fact, it was thought that just shortening the lecture time with certain topics and starting at a slightly advanced level would suffice.

There were many important similarities between the two upper division courses. The major homework assignments involved project work which was different from the homework assignments in the 200-level course. It was thought that the real-world nature of the projects and the extent of the development life cycle coverage coupled with the level and extent of topics covered in lecture would enable students to attain a significantly higher skill level than they had attained in the earlier course.

COURSE EXPERIENCE

As we commenced the semester, we naively thought that after selecting a text book, deciding on major homework/project assignments and familiarizing ourselves with the coverage, both topic and level, in the 200-level course that we had addressed and resolved major issues/problems with these two courses. Very quickly, it became apparent that for many of the students in the upper division courses that there was a vast difference in what the previous course's instructors and syllabus indicated was covered and what the students' acquisition, remembrance, and perception of topics covered was.

Perhaps it is only natural for students to disclaim knowledge of a topic in the hopes that the instructor will refresh their memories and delineate exactly the material for which they are to be held accountable. We found that students in the upper-division courses were very quick to claim either that they had never been introduced to certain material or that it had only been covered in passing. Very often queries to their previous instructors indicated that the students were simply mistaken on the details. They had covered the material; they just had not been exposed to it in the same context that students from other sections had been. Consequently they perceived this sort of material as "completely new". Given the combinations of sections feeding the advanced courses, the frequency of this sort of complaint was very high. Of course some of the complaints turned out to be accurate. In either situation, however, the result was pretty much the same. Either some time had to be allocated in the upper-division course to get everyone on the same "page", or a large portion of the class was going to be operating at a disadvantage.

The spiral approach the department designed had not intended to duplicate the first course material in the second, but rather to build on the former in the latter. Where the second course built on methods covered in the first, it was intended to do so by dealing with the practical application of the methods. Any time spent covering the lower-division material in the upper-division course adversely impacted the amount of material which could be covered in the latter.

We did find that where the students perceived that they understood various methods and techniques coming into the course they expressed a higher level of comfort with the project assignment than previous groups of students had. The systems analysis and design class, for example, was divided into 5-6 person teams. The team as a whole would have a higher level of confidence than in previous years. Since some members of the team felt confident of the methods and techniques learned in the lower-division course this ability was available to the team as a unit. Of course team members worked with each other to bring each up to speed, and this accelerated the learning activity.

Given the assumption that the lower-division course had established certain fundamentals, the upper-division course focussed on the applied nature of the material. With the time bought by covering modeling in the lower-division course, it became possible to spend more time than usual on project management. Classroom lectures stressed the flow and interaction between various activities within the lifecycle, as opposed to teaching, e.g., stand-alone model development. Of course as these topics were being covered, the live project reinforced the lecture material.

In the 300-level database course, the students' perception of the material covered varied more that expected. In fact, the prior coverage of material was different because of a curriculum sequence that hadn't been adequately considered. The database course actually serves two distinct groups of students. It is the direct follow-on database course for the undergraduate core course on database and system development. In addition, it may be the first database course for graduate students. Graduate students are required to take at least one of two database courses. At this level, graduate students without sufficient database experience or prerequisites for the 400-level database course take the 300-level database course.

Some students who had taken the undergraduate sequence complained that there was too much overlap and not enough new material in the course. However, in some areas which students had flagged as having dual coverage, students did not demonstrate the expected level of understanding or competence. For example, in the area of data modeling, a topic first introduced in the 200-level course in some detail, students did not demonstrate the level of expertise to be able to develop an entity-relationship model for a practical situation. The expectation is that students learn the fundamentals of data modeling in the 200-level course and then develop the ability to apply the concepts in the 300-level course. The problem was to develop this ability to apply the concepts without seeming to repeat the material covered in the earlier course.

In an attempt to address this particular problem, the instructor of the database course met with students to discuss and review a revised syllabus and presentation approach. This semester, topics that have been covered previously are not addressed in the "standard lecture format" as they have been. Instead problems have been selected that require students to use the various modeling techniques in developing a data model for the particular problem or scenario. In implementing this approach, two slightly different methods have been used. In one case, the class has been divided into three groups and different problems are assigned to each group. The group develops a solution and then presents and discusses it in class. In the other case, all students are given selected problems as homework. Then the instructor discusses the problem and presents various solutions. So far students seem to be able to handle the simpler more straightforward problems. However, in the case of richer more complex problems, it is often necessary for the instructor to conduct the discussion. This general approach seems to be working; at least, it involves the students and encourages them to more active in the learning process. One problem with this approach is that the lectures are not as structured so that it is difficult to ensure similar coverage in multiple sections or to document the coverage that actually takes place. In addition, the open discussion is very dependent on the instructor's level of experience and expertise. Another problem is the amount of class time required to develop the discussion and to cover the topic area in this manner.

The former students were in favor of this method of presentation and strongly recommended it. However, it remains to be seen how the students currently experiencing the different approach will evaluate it and what level of competency they will acquire.

For students coming into the course with alternate courses or experience used to satisfy prerequisites, a special attempt was made to recommend outside supplementary readings and to make available a multimedia presentation on the basics of data modeling.

CONCLUSIONS

After teaching the two follow-on courses, it is apparent that more *planning and development* work needs to be done in order to affect a smoother transition along the spiral. It is also apparent that textbook selection for the involved courses also becomes an item of concern in the articulation between the courses. The paper has discussed the procedures being used to attain a better articulation between the courses and to monitor the ongoing process as well as suggesting some additional procedures that could be used.

Articulation between courses and instructors, especially in a large program, is very difficult. The individual strengths of various instructors play to articulation difficulties. On the positive side, instructors convey the material in which they have a high level of expertise to their students exceptionally well. On the negative side, this more thorough coverage can contribute to shorting the time and depth of coverage for material which the instructor finds less interesting, for whatever reason.

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GUI AND OBJECT ORIENTED PROGRAMMING IN COBOL

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Various schools are struggling with the introduction of Object Oriented (OO) programming concepts and GUI within the traditional COBOL sequence. OO programming has been introduced in some of the curriculums with languages such as C++, Smalltalk, and Java. Introducing OO programming into a typical COBOL sequence presents some interesting challenges. There are a number of new concepts to introduce along with various design issues that are relatively new to OO program design such as file maintenance and data objects. Most C++ programming courses tend to work with objects that are more user interface related such as traditional GUI objects. This paper describes an example of using OO COBOL and Dialog Systems (GUI builder) in an Advanced Programming Applications course.

INTRODUCTION

"COBOL is in a unique position to bridge the past with the future. COBOL practitioners bring a wealth of experience spanning all phases of the software life cycle including analysis, design, implementation, database integration, and maintenance" [Arranga, 1997]. The inventory of legacy systems continues to be estimated at around 180 billion lines of COBOL code. Some organizations (typically technology and engineering based companies) have migrated away from using COBOL. They have done this by going to client-server systems using databases such as Oracle, Sybase and DB2 along with client tools such as Visual Basic, Powerbuilder, and Oracle tools. Many organizations are still committed to their COBOL based systems because of the high investment in these systems, the high cost to rebuild the systems, and the inability of the newer client-server technologies to handle the loads in large systems (salability). OO COBOL, GUI builders (such as Micro Focus Dialog Systems and IBM Visual Age for COBOL) and the integration of these products with common object standards (Common Object Request Broker Architecture - CORBA), may provide an alternative for many of these organizations to migrate their legacy systems into newer systems based on the new technologies.

GUI AND COBOL USING DIALOG SYSTEMS

Adding GUI (windows) to COBOL program development is very easy today with the use of either Micro Focus Dialog Systems or IBM Visual Age for COBOL. The examples shown in this paper were done using Dialog Systems. The window shown in figure 1 is a passenger reservation window that is used to maintain data using a traditional VSAM file structure with a primary key (itinerary number) and two alternate keys (passenger name and flight number).

FIGURE 1

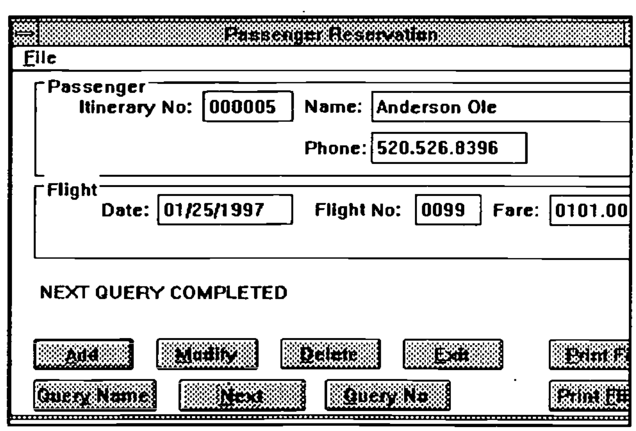
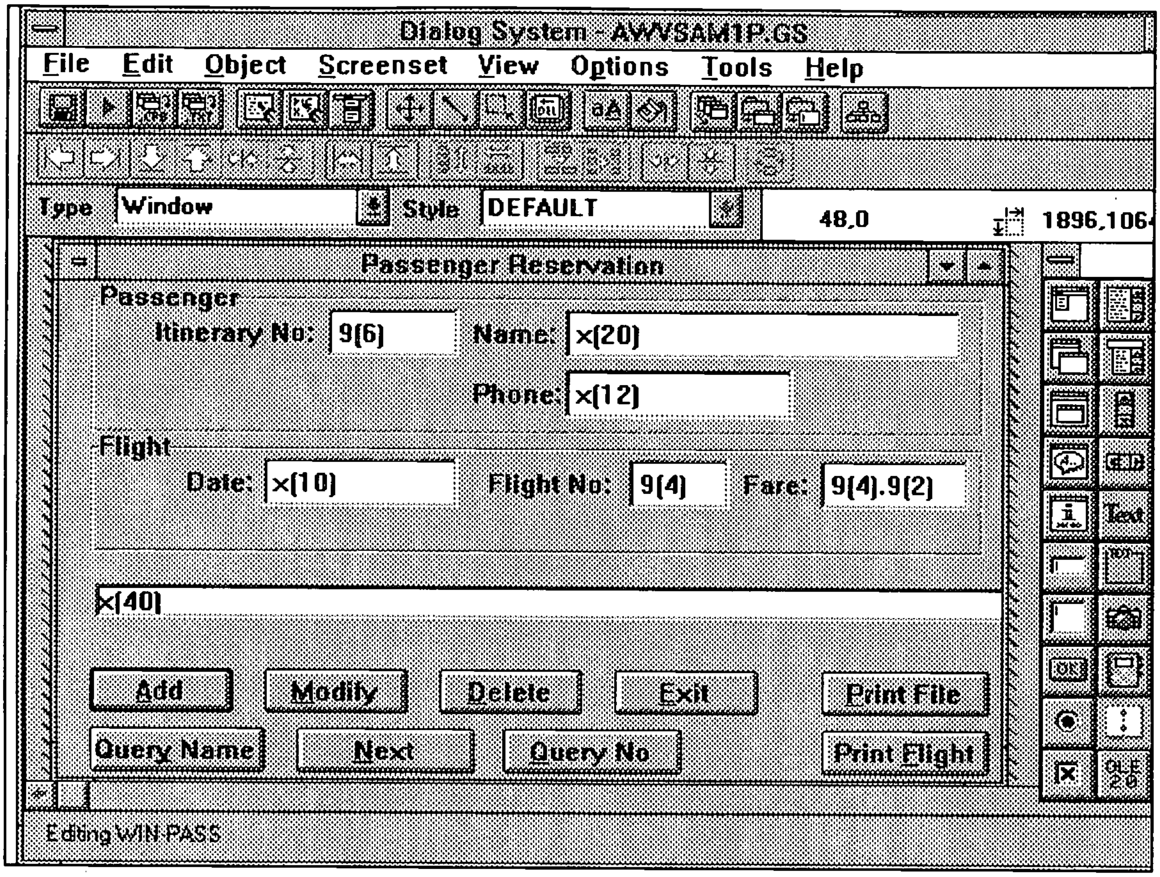


FIGURE 2



The window is built using the Dialog Systems object palette or object pull down menu shown in figure 2. Objects available include primary window, secondary window (clipped and unclipped), dialog box, message box, entry field, multiple line entry field, push button, radio button, check box, list box, selection box, text box, group box, bitmap and notebook.

Normally you start the build process by defining a set of data to be used with the window. The data is referred to as a data block and is defined similar to COBOL. The data block can be entered in Dialog Systems or imported from a COBOL data definition. The data block used for this window is shown in figure 3.

Normally a data element is defined for each field supported on the window along with any other fields necessary to support communication between the window and the application program. X300-Action is used to communicate a code to the application program, so the

FIGURE 3

FLD NO	FIELDNAME	FORMAT	LENGTH
1	X300-ITINERARY-NO	9	6.00
2	X300-NAME	X	20.00
3	X300-PHONE	X	12.00
4	X300-DATE	X	10.00
5	X300-FLIGHT-NO	9	4.00
6	X300-FARE	9	4.02
	X300-ACTION	X	1.00
8	X300-MESSAGE	X	40.00

application program knows which button the user pushed when control is turned over to the application program. Each of the other fields is associated with a entry field or display field on the window. A copy block (file) of COBOL definitions corresponding to each field on the window is generated by a command on the file menu. This file is called using a copy statement in the Working Storage Section of the COBOL program. This assures that the data definitions in the application program are exactly the same as the data definitions on the window.

The operation of a window is controlled by events. Events can be trapped at various levels such global (events associated with all windows in the set), for each specific window, and for each specific object on a window. Examples of events include window created, closed window, item selected, mouse over, button selected, gained focus, lost focus and various other events. Each event can be trapped at different levels and programmed to carry out various functions. This programming is called script and is executed as part of the windows operating system. Figure 4 shows some examples of script that are used on this window. Escape and Closed-Window have been defined in this application to exit the application. The application program has been programmed to exit when it sees an 'X' in the action code. The command RETC is a script command to leave the window and return to the calling (application) program. The local dialog for the window traps the exit menu selection under File and also closes the application. If the escape and closed-window events under GLOBAL were moved to LOCAL for the window win-pass, then those events would be trapped only when that window is in focus.

Script is written for each button to tell the application program which routine to execute when control is returned to the application program. When the application program returns to the window, the window program continues to execute the script that is was on when it turned control over to the application program. The ADD push button script illustrates this with the execution of the REFRESH-OBJECT $WINDOW command after it returns from the calling program. The application program sends additional data back to the window, and the window must be refreshed in order to display that data. The window is displayed at the end of any script that is executed after control has been returned to the window program.

FIGURE 4

```
GLOBAL DIALOG:
        ESC
                MOVE "X" X300-ACTION
                RETC
        CLOSED-WINDOW
                MOVE "X" X300-ACTION
                RETC

LOCAL DIALOG:
        @MNU-EXIT
                MOVE "X" X300-ACTION
                RETC

DIALOG FOR PUSH BUTTON : PB-ADD
        BUTTON-SELECTED
                MOVE "A" X300-ACTION
                RETC
                REFRESH-OBJECT $WINDOW
```

Two blocks of data (data block and control block) pass between the application program and the Dialog Systems Program (DSRUN) each time control is passed from one to the other. The application program calls the Dialog Systems program with a subprogram Call Statement. The code in the application program that is used to communicate with Dialog Systems is shown in Figure 5. The program-initialize routine is executed once at the beginning of the application to set up some of the parameters in the control block. The Call-Dialog routine is used each time the application program returns control to the window. Note that the Call statement calls Dialog-System as a subprogram using the control block and the data block.

Setting up windows like this allows faculty to illustrate all of the components of client-server programming using COBOL as the application language. The client (window program) is running various scripts that control operations at the client. The application program could be running on any platform such as an application server. If the application program has embedded SQL to an Oracle server, you are able to illustrate full 3-tier architecture in a COBOL environment. Dialog Systems supports a robust windows environment including data validation, list boxes populated by repeating group fields (tables), and multiple windows.

FIGURE 5

COBOL CODE TO SUPPORT DIALOG SYSTEMS

```
u500-Program-Initialize.
        Initialize DS-CONTROL-BLOCK, DATA-BLOCK
        Move DS-NEW-SET to DS-CONTROL
        Move VERSION-NO to DS-VERSION-NO
        Move DATA-BLOCK-VERSION-NO to DS-DATA-
                BLOCK-VERSION-NO
        Move "awvsam1p" to DS-SET-NAME
        Perform u510-Call-Dialog.

u510-Call-Dialog.
        Call Dialog-System using DS-CONTROL-BLOCK,
        DATA-BLOCK if  DS-ERROR-CODE not = 0
                Display "Dialog Error"
                Stop Run
        else
                move X300-action to 400-action
        end-if.
```

APPLICATION PROGRAMMING IN OO COBOL

The application program used in this paper to illustrate object oriented programming in COBOL is based on a model developed by Will Price in his text on Elements of Object-Oriented Programming in COBOL [Price, 1997]. I used his model to rebuild the VSAM update program that uses the window described in the preceding section. The model has a driver program, a passenger class and a database interface (DBI) class. Each class is a separate object program. The driver is a procedural COBOL program and not a object COBOL program. In this illustration, the driver contains the user interface (interface to Dialog Systems), and most of the application logic. All of the I-O has been transferred from the driver to the DBI. All of the interaction with passenger data has been placed in the passenger class. Each class is similar to a sub program in COBOL. A class can have multiple methods (sub programs) within the class. A method is called using an INVOKE command.

In object programming there are various cycles to the life of an object. The first cycle is to create the object. This is done in COBOL with the following command:

```
Invoke PassClass "New"
        Returning thePassHandle
```

The variable 'thePassHandle' is a new COBOL object reference variable that is used to maintain a pointer to the object space that is created in memory. Once the object has been created, the object can be populated with data (second stage of the life cycle) by referencing it using the handle. The sub program (method) "populate-the-pass-object" is executed using the data in 200-pass-record of the program executing the invoke.

```
Invoke thePassHandle
        "populate-the-pass-object"
        using 200-pass-record
```

The next stage in the life of an object is to manipulate or use the data. Object data can only be accessed through the methods associated with that object. The following statement would return data currently held by this passenger object to a program that wanted to pass the data to a window for displaying it.

```
Invoke thePassHandle "return-pass-data"
        returning 200-pass-record
```

The entire class program for passenger is shown in figure 6. The differences to note compared to a procedural COBOL program are as follows: 1) Class-id instead of Program-id, 2) Object Section, 3) Class control associates the class names (logical names) with physical file names on the disk, 4) OBJECT starts the definition of the object, 5) the data definitions for the object data, 6) each method definition under the procedure division is like a separate little sub program. Note that each method can have its own linkage section and local working storage section. The object data is global to all methods within this class.

A passenger object is created during the application of this program each time passenger data in read from the file, or each time a new passenger is added to the file. In this example, the same passenger handle is used for each passenger object, so once a new passenger object is created, there is no access to previous passenger objects. OO COBOL has its own garbage collection management system so the programmer does not have to mange it. More than one object of the same class can be maintained at the same time through the use of multiple handles that would be managed as part of a stack or table.

FIGURE 6

PASSENGER CLASS

```
$set ooctrl(+n)
$set sourceformat "free"
*>****************************************************************
*> Airwest Reservation System
*> 1/8/97          AWPA01CL.CBL
*>
*> This is the basic passenger class
*> Object data is:
*>   itinerary number
*>   name
*>   phone
*>   date and flight number
*>   fare
*> Methods are:
*>   return-pass-data
*>   populate-the-pass-object (invoked by DBI)
*>***************************************************

Identification Division.
    Class-id.  PassClass
          inherits from Base.

Environment Division.
    Object Section.
    Class-Control.
      PassClass is class "awpa01cl"
      Base      is class "Base"
      .
*>=================================
OBJECT.
 Data Division.
  Object-Storage Section.   *> OBJECT DATA
  01 Pass-data.
      03 200-itinerary-no       Pic 9(4) comp.
      03 200-name               pic X(20).
      03 200-phone              pic X(12).
      03 200-date               pic 9(8) comp-3.
      03 200-flight-no          pic 9(4) comp.
      03 200-fare               pic 9(6)V9(2) comp-3.

Procedure Division.
  *>--------------<*
  *> Object Methods <*
  *>--------------<*

*>-----------------------------
Method-id. "populate-the-pass-object".
*>-----------------------------
 Data Division.
  Linkage Section.
   01  ls-pass-data.
       03 ls-itinerary-no       Pic 9(4) comp.
       03 ls-name               pic X(20).
       03 ls-phone              pic X(12).
       03 ls-date               pic 9(8) comp-3.
       03 ls-flight-no          pic 9(4) comp.
       03 ls-fare               pic 9(6)V9(2) comp-3.

  Procedure Division  Using ls-pass-data.
   Move ls-pass-data to pass-data
   .
End Method "populate-the-pass-object".
*>-------------------------------


*>-------------------------
Method-id. "return-pass-data".
*>-------------------------
 Data Division.
  Linkage Section.
   01  ls-pass-data.
       03 ls-itinerary-no       Pic 9(4) comp.
       03 ls-name               pic X(20).
       03 ls-phone              pic X(12).
       03 ls-date               pic 9(8) comp-3.
       03 ls-flight-no          pic 9(4) comp.
       03 ls-fare               pic 9(6)V9(2) comp-3.

  Procedure Division  Returning ls-pass-data.
   Move pass-data to ls-pass-data
   .
End Method "return-pass-data".
*>-------------------------
END OBJECT.
END CLASS PassClass.
```

A partial listing of the database interface (DBI) class is shown in Figure 7. The database interface object is created once for the duration of the application program. The database interface has all of the file definitions and the methods to open, close, write, rewrite, read (using every index) and start (using every index or staring parameter). If this application were switched to a relational table, DBI would be changed to SQL calls to an Oracle or DB2 database. In most cases, if this change were made, the programs using the DBI would not have to be modified.

The database interface class has not defined any object data. This class defines methods only. The driver program creates the database interface object once and then invokes the object method 'open-pass-file' to open the VSAM file. From that point, the driver program can initiate read, writes, and rewrites by using the methods in this DBI.

The overall object structure of the DBI is the same as the passenger class with the exception that there is no object data. The partial listing shows one read method. Most of the read methods are all the same except that they use different indexes or start statements. Note that once the read is complete, a new passenger object is created and a method is called to populate that passenger object with the data that was just read. If the read fails the handle is set to null. The handle is used two ways. If the handle returns to the program with data in it, then the read was OK and the reference to the object is contained in the handle. If the handle is returned as a null, then the read was not OK, and the invoking program can process the exception by notifying the user.

FIGURE 7

DATABASE INTERFACE (DBI) CLASS

```
$set ooctrl(+n)
$set sourceformat "free"
*>*********************************************************
*> Airwest Reservation System
*> 1/08/97          AIRW01DA.CBL
*>
*> Airw01da maintains the VSAM file for the Airwest
*> reservation System.
*>*********************************************************

Identification Division.
    Class-id.    AirwDatabaseInterface
                 inherits from Base.

Environment Division.

 INPUT-OUTPUT SECTION.
 FILE-CONTROL.
 SELECT 200-AwPass-file ASSIGN TO
            "C:\pcobwin\airwest\airw.mst"

   ORGANIZATION INDEXED
   ACCESS DYNAMIC
   RECORD KEY 200-itinerary-no
   alternate record key is 200-name
   with duplicates
   alternate record key is 200-flight-no
   WITH DUPLICATES.

 Object Section.
   Class-Control.
    AirwDatabaseInterface         is class "airw01da"
    Passclass                     is class "awpa01cl"
    Base                          is class "Base"
    .

   Data Division.

   File Section.

   FD 200-AwPass-file.
   01 200-Pass-record.
      03 200-itinerary-no       Pic 9(4) comp.
      03 200-name               pic X(20).
      03 200-phone              pic X(12).
      03 200-date               pic 9(8) comp-3.
      03 200-flight-no          pic 9(4) comp.
      03 200-fare               pic 9(6)V9(2) comp-3.

*>=================================
OBJECT.
 Data Division.
  Object-Storage Section.   *> OBJECT DATA
   01 thePassHandle         object reference.

 Procedure Division.
 *> Object Methods <*

 *> Method Open Passenger File <*
    Method-id. "open-pass-file".
    Procedure Division.
         Open I-O 200-AwPass-file
    .
  End Method "open-pass-file".

 *> Method Read Passenger File <*
    Method-id. "read-pass-file".

  Data Division.
    Linkage Section.
```

```
01 ls-itinerary-no        pic 9(04) comp.
01 ls-thePassHandle       object reference.

Procedure Division Using ls-itinerary-no
        Returning ls-thePassHandle.

  Move ls-itinerary-no to 200-itinerary-no

  Read 200-AwPass-file
    invalid key
      Set ls-thePassHandle to null
    Not invalid key
      Invoke PassClass "New"
          Returning thePassHandle
      Set ls-thePassHandle to thePassHandle
      Invoke thePassHandle
        "populate-the-pass-object"
        using 200-pass-record
  End-Read

.
End Method "read-pass-file".

*> Method New Passenger Record <*
Method-id. "new-pass-record".

Data Division.

 Linkage Section.
 01 ls-Pass-record.
     03 ls-itinerary-no     Pic 9(4) comp.
     03 ls-name             pic X(20).
     03 ls-phone            pic X(12).
     03 ls-date             pic 9(8) comp-3.
     03 ls-flight-no        pic 9(4) comp.
     03 ls-fare             pic 9(6)V9(2) comp-3.
 01 ls-thePassHandle      object reference.

 Procedure Division Using ls-pass-record
         Returning ls-thePassHandle.

   Move ls-pass-record to 200-pass-record
   Invoke PassClass "New"
         Returning thePassHandle
   Set ls-thePassHandle to thePassHandle
   Invoke thePassHandle
       "populate-the-pass-object"
         using 200-pass-record

   .

End Method "new-pass-record".

Method-id. "write-pass-file".

   Procedure Division.
     Invoke thePassHandle "return-pass-data"
             Returning 200-pass-record
     Write 200-pass-record

     .
 End Method "write-pass-file".
END OBJECT.
END CLASS AirWdatabaseinterface.
```

SUMMARY

COBOL 97 and other tools such as Dialog Systems and Visual Age for COBOL are paving the way to enhance the traditional COBOL sequence in CIS curriculums into the new technologies. Much of the large corporate enterprise-wide systems world, with its 180 billion lines of COBOL code, is still looking for direction as a way to migrate. Object oriented development in COBOL may be part of the answer to this migration dilemma. IBM, Micro Focus and Hitachi have all invested large sums in the development of OO Cobol. Change in these large legacy systems over the years has always been slow. Most organizations today are too bogged down with the year 2000 problem and normal maintenance to do much experimental work with object technologies today. However, as we move past the year 2000, we will see a lot more activity with object technologies. Exposing our students to object oriented programming applications using business system applications will give them an introduction to the technologies they will encounter in working on information system development projects when they graduate.

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KEY PROCEDURES IN USER INTERFACE DEVELOPMENT

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Information systems (IS) professionals are called on to produce increasingly sophisticated user interfaces as a part of software development. Although IS education includes coverage of user interface (UI) development, classroom presentation of this topic frequently is cursory and does not provide any particular methodology for the task. In this paper, we present a set of procedures for teaching UI development with a "how to" approach, based on research and practice in the field of Human Computer Interaction (HCI). Initial application in the classroom suggests this approach is useful for focusing students' conceptual understanding of the topic without increasing required classroom time or resources when compared to traditional methods.

INTRODUCTION

The onrush of new user interface technologies and a lack of HCI specialists in the field of IS have combined to make UI development a common activity for mainstream IS professionals. However, students in IS academic programs are not well prepared for this responsibility as they frequently receive only a cursory introduction to the topic. This is due primarily to two factors. First, the treatment of UI development and other aspects of HCI is spread thinly across the curriculum. The IS '95 curriculum proposal [7] suggests that in-depth study of the topic should be presented in both the programming language and the physical design curricula. However, UI development is not the central focus in either of these courses, and the small amount of classroom time that can be devoted to the topic in either course implicitly limits the depth of student learning.

Second, course textbooks avoid the issue of how to develop a UI. Instead, texts tend to broadly survey UI categories and their characteristics, touching on such diverse topics as command line instructions for mainframe computers, graphical user interfaces (GUIs), multimedia computing, and even virtual reality. From their texts, IS students may learn what a dialog box is and receive isolated tips such as "use command verbs clearly" and "don't display blue text on a red background." What students do not learn is a specific method for UI development that they can use in their subsequent careers in the manner that they are able to apply, for example, data flow diagramming or flowcharting techniques.

Skills in UI development will continue to be important for mainstream IS students. Since HCI specialists are relatively rare in the IS profession and UIs are a major part of current practice in event-driven programming, it is foreseeable that today's IS students will be responsible for developing UIs during their careers. Thus, there is a compelling need to overcome the limitations of course time constraints and shallow texts in teaching this topic.

This paper presents a set of procedures for UI development that we have found to be useful both in stand-alone training and as augmentation for textbook treatments of the topic. In the following sections, we discuss the background leading to the research, describe the procedures, and highlight ways they can be applied in practice.

BACKGROUND

IS programs that offer specialization in HCI require one or more courses in User Interface Design, supported by study in Cognitive Science, Human Factors of Information Systems, and additional electives in HCI [1]. We do not propose that it is desirable, or even possible, to add this volume of coursework to the mainstream IS curriculum. Instead, our approach focuses on isolating and presenting the procedures that HCI user- and task-centered research has found to be key to pedagogy and practice. Our objective is to enhance the instruction of UI development within systems analysis and design or advanced programming courses without the need to alter existing course schedules.

Our criteria are, first, that the procedures must be sufficiently basic that students can quickly grasp the major concepts. Although basic instruction inherently lacks depth, our intention is to provide a framework to which students can add the experiential learning they presumably will gain during their careers. Second, the procedures must prescribe specific activities or ranges of activities to be performed in a systematic fashion. Third, the procedures should avoid assumption of particular technologies or other contingencies. Finally, it must be possible to present the material effectively during a single class period of 50 to 80 minutes length.

The result of our research is the list of six procedures profiled in Table 1. The procedures may be combined to portray a skeletal method of UI development that is adaptable to a wide range of programming environments and UI formats. In the following sections we describe the individual procedures and suggest ways of integrating them into standard systems analysis and design procedures.

Determine Factors That Constrain the UI

Determine the factors that are most important in constraining the form and function of the UI; these are the UI constraints. We propose three categories of factors to be central to the success of UI development within the organizational contexts that are typical of IS practice. These relate to:

- the users of the UI–who will use it?
- the tasks that will be performed with the UI–what will it be used for?
- the environments in which the UI will operate–where and how will it be used?

The determination must be sufficiently detailed to avoid abstractions that may otherwise mask UI problems. For example, focusing on the average age in a department of data entry workers would likely mask the fact that a sizable portion of the workers are over 45 years old, and that these specific workers have great difficulty reading small font sizes on a computer monitor. The determination must be adequately documented so that standards to which the UI is designed and tested are unambiguous. At the same time, the documentation process should be streamlined so that UI developers can use it as an interesting and helpful means to understand system constraints and focus their subsequent development efforts, rather than just another form of tedious paperwork.

Determine Users. Early computer interfaces were difficult for most people to use, limiting the situations where the systems could be deployed. Researchers in HCI developed user-centered design as a way to improve system performance through understanding the important characteristics of system users. Norman writes, "As we expand the base of the [computer] user population, we must attend more and more to the needs and abilities of a variety of users" [11 p. 11]. Initially, user characteristics were studied with the idea of configuring system features for each particular user need or style. However, research indicates that it is more practical to build systems that are sufficiently flexible to accommodate the anticipated range of use than to try to match the system to each individual special characteristics (for discussion of this issue, see Huber, 1983).

Users should be specified by name and job description, and a set of pertinent user characteristics should be developed from these specifications (see Table 2). Knowing who will use the system and what they do is helpful in deciding which characteristics are pertinent to

TABLE 1

KEY PROCEDURES IN USER INTERFACE DEVELOPMENT

Procedure	Stage in Process	Description
Determine factors that constrain the UI	Early	Determine and list the most important factors relating to the users of the UI, the tasks that will be performed with it, and the environments where it will operate
Leverage users' skills	Early	Review listing of users' skills to identify those that will be most important to leveraging the usability of the UI
Adopt operating system standards	Early	Use the OS manufacturer's guidelines as the primary standard for UI development
Visualize prior to coding the product	Middle	Visualize the finished design in two separate stages using cocktail napkin and mock-up techniques
Observe prior to releasing the product	Middle to late	Perform user testing of mock-ups and working project components using a simple think-aloud technique
Conduct planned iteration among the procedures	Throughout	Plan ahead and budget for iterative development, especially for cycling between the visualize and observe procedures

TABLE 2

EXAMPLE LISTING OF UI CONSTRAINTS

User	Task	Environment
Demographic factors Age Gender Height Able to telecommute? Salaried or hourly?	Simple task (in spreadsheet) Enter formula to sum range A4:B7 Copy cell A5 to cell D8 Complex task Create histogram bar chart of range A1:A28 Make formula and cell entries to calculate varying rates, periods, and loan amounts	Technology Computers: Mix of Intel 386, 486, and Pentium PCs O/S: MSDOS ver. 5.0 Other environments Management structure Physical facilities Market competition Industry practices Legal and regulatory Socio-cultural
Skills Computer spreadsheet programming skill English language fluency Data entry speed		
Personal Learning style Cognitive complexity Visual acquity Color vision	Scenario John is creating a check register in Excel. He is a proficient Lotus 1-2-3 user but has never used Excel. He can create the register by performing tasks A, B, and C.	

the UI and is key to understanding the range that can be expected for each characteristic. Once the user-related UI constraints are decided upon and documented in a simple listing, information about them can be collected as a part of user requirements elicitation accompanying systems analysis. However, if it is not possible to contact all system users, it is important to find users who are representative of the identified target group, especially in their technology skills and interests.

Determine Tasks. HCI research also suggests that task has important consequences for UI development. Lewis and Rieman present a task-centered design method that "focuses on real, complete, representative tasks ... [vs.] abstract, partial task elements" [6, chap. 2]. In task-centered design, UI developers interview representative users to develop task specifications in the following steps:

1. collect actual tasks that the UI will be used to accomplish, ranging from simple to complex in action;
2. ask what the user wants to do, not how to do it, thus avoiding the tendency to define the task too narrowly within preconceived technical constraints;
3. develop scenarios that encompass individual tasks as well as interactions among tasks; and
4. use task scenarios to highlight what UI features will be necessary to accomplish the tasks and to infer how these features will be applied in practice.

The described task-centered approach should be used for UI constraint determination as far as is practical. However, there rarely will be time in practice to both develop and fully document large numbers of sample tasks and scenarios. Thus, we suggest that developers focus their efforts on collecting a representative variety of tasks and scenarios and limit the documentation of these to simple descriptions of the type shown in Table 2. Task-related UI constraints should be collected during user requirements elicitation.

Determine Environments. User- and task-centered design are valuable aids to UI development in IS projects, but additional factors are important for systems that are to be used in organizational contexts, as is typical in IS. We call these general factors environments in recognition that they surround the user and task. Some environments that are potential UI constraints are management structure, technology, and industry practices (see Table 2). Although a given project is likely to have many related environmental factors, it is incumbent on the developer during the determination process to focus on only those that place important constraints on the UI. In many cases these environments will become evident during requirements analysis. However, important factors frequently surface as additional users, managers, and other stakeholders become acquainted with the system. Thus, UI developers should be open to the possibility of emergent environmental determinants and be prepared to evaluate and document these as they arise.

Leverage Users' Skills

Apply users' existing skills to leverage the usability of the UI. Regardless of background, users bring a great number of skills to their interaction with a system. Leveraging applies users' existing skills to minimize difficulties in dealing with the new situation. For example, it will be easier initially for users to fill out an on-line replacement for a paper form if it has the same layout and requires the same entries as the form they have been using. Baecker and Buxton [2, p. 212] recommend four procedures to aid leveraging:

- build upon the users' existing set of skills;
- keep the set of skills required by the system to a minimum;
- use the same skill wherever possible in similar circumstances; and
- use feedback to effectively reinforce similar contexts and distinguish ones that are dissimilar.

In leveraging, it is useful to consider user skills from two distinct viewpoints. First, group norms are important for directing the baseline UI features; these can be thought of as the central target of the system's flexibility to accommodate users' needs and special skills. Second, consideration of individual users or subgroups who vary from the norm in one way or another (e.g., novices or "power users") will provide a gauge to the amount and type of flexibility that should be incorporated into the UI (e.g., whether to incorporate "balloon help"). The list of user-related constraints that is developed during specification should inform the leveraging process. The skills in this list that are most important to leveraging should be identified, and the constraints list should be updated to include any additional user skills that emerge during this review.

Adopt Operating System Standards

Adopt operating system standards for UI design. In UI development, it is imperative that developers make a concerted effort to fail to invent new UI designs and interaction methods. This is important to productivity both for developers, who must take time away from other activities to invent and implement the new feature, and for users, who must learn how to use the feature. Brown states, "Consistency is one of the most obvious human-computer interface design goals, but one that requires perhaps the most discipline in the design process" [4, p. 9]. There is always some tendency for UI developers to experiment unproductively unless their designs are anchored in documented standards. We propose that system-level UI guides, e.g., [8], provide the best standards for programmers who are not HCI specialists, and we recommend that UI developers obtain and review the appropriate guide prior to beginning design work. System-level UI guides enhance programming productivity by presenting current standards, being specific to the intended computing environment, and providing relevant coding examples and guidelines. Our advice is not intended to discourage interest in general books on UI design (e.g., [4, 13, 14]), however, generalized information is not an adequate substitute for system-level documentation.

Visualize Prior to Coding the Product

Use two types of visualization techniques to explore UI designs. We recommend using two distinct visualization techniques to quickly create and refine UI designs. Cocktail napkin visualization is performed early in the design stage, with the developer producing small, rough drawings with little attention paid to clarity or detail. These are drawn rapidly one after the other, typically in a private setting, until the developer is satisfied with the emergent design. Cocktail napkin visualization has several important characteristics:

- Drawing overcomes a natural tendency to overrely on mental models by moving the design into a visible medium. Norman [10] points out that mental models are frequently incomplete, they are unstable, and it is hard for people to visualize dynamic actions in their mental models. Drawing exposes problems to view.
- Fast production of the drawing on a small scale serves to minimize the developer's investment in the particular version and the tendency to commit to it. Thus, fast production avoids freezing the design prematurely.
- The act of producing designs in private promotes creativity by relieving the developer of concerns about external review or criticism. Although cocktail napkin visualization can be conducted in groups, many people are embarrassed about their drawing skills and will spend excessive amounts of time trying to complete a single design as perfectly as possible.

When the developer is satisfied with the cocktail napkin design, the final version should be carefully annotated with any supporting information that might be forgotten with the passage of time, e.g., titles of command buttons, dynamic actions on screen, and description of graphics. The annotated designs may then be shared with, and reviewed by, other members of the development team.

Mock-up visualization is the detailed portrayal of the actual system or parts of the system. Depending on the tools at the developer's disposal, this may be created either off-line or on-line. Off-line mock-ups typically are created entirely on paper, with commands, buttons, graphics, etc. shown in position. Each UI screen is represented by one sheet of paper for a static display, or more sheets if the screen displays dynamic information or animation. On-line mock-ups are created using a development environment suitable for rapid application development (RAD), e.g., Visual Basic, Delphi, HyperCard, or a prototyping tool. In either case, development of the mock-ups should be completed quickly, since it is quite likely that subsequent observation will suggest important changes to the design.

Where it is difficult to provide built-in functionality in mock-ups, e.g., ability to print the document shown on the screen, this can be supported by *Wizard of Oz* techniques [14, p. 101]. These techniques, based on the *faux* wizard in the story of the same name, are used to augment mock-ups with a human intermediary who acts out a part of the system by describing what actions the system performs when the user interacts with the interface.

In large systems, it may be impractical to simultaneously mock-up the UI for the entire system. For these cases, Nielsen [9] recommends developing horizontal and vertical mock-ups based on task-scenarios such as those specified in the UI constraints. Horizontal mock-ups show the broad appearance of the application, e.g., menus, dialogs, and windows. Vertical mock-ups are designed to provide sufficient depth and detail of a particular part of the system to show how it will react in specific scenarios.

Observe Prior to Releasing the Product

Observe users of the UI with the mock-ups you have created. Observation should be planned with the goal of decreasing the overall expense of the project. For user observation, we recommend UI developers employ a think-aloud technique that is simple to apply and analyze. In this technique, the UI developer finds representative users to "try out" the system under development. Ideally, these would be individuals who represent the intended user group and whose actions are not biased by experiences with a previous mock-up. The following procedures for the think-aloud technique are summarized from Lewis and Rieman [6]:

1. Place the user in position to access the system and describe the task scenario he or she is to work through. Description of task scenarios should focus on what the user is expected to accomplish, rather than how it should be done.
2. Explain how to think aloud: "You should say aloud what you are thinking about, concerning the system, as you work. If you quit talking I'll remind you to speak up. Go ahead and begin." Make it clear that if users have trouble it is the system's fault and not theirs.
3. As the user works, avoid volunteering information to explain the system's operation, as your purpose is to see how the user will progress without a human guide. Either explain in advance that help cannot be given during testing or plan ways to avoid leading the user when giving help. If the user quits talking, give a prompt to "Tell me what you're thinking."
4. Pay special attention to any areas where the user is blocked (can't progress without help), backtracks (retraces steps due to uncertainty of how to proceed), misappropriates (incorrectly uses commands or tools), or accesses on-line help functions. Keep notes primarily in writing, but also consider making unobtrusive audio or video recordings with the user's permission.

Observation sessions should not be lengthy, as both users and developers tire quickly when concentrating on their roles. After each observation session is completed, notes from the session should be reviewed and summarized, paying special attention to unexpected user actions. The designer must bear in mind that the intention is to test the interface, not to validate it. Avoid the temptation during review to "gloss over" or rationalize user problems. Incorporating early cycles of observation can highlight unexpected problems while it is still inexpensive to fix them. In fact, the relative cost to fix errors discovered in the early design phases has been reported to be less than one-hundredth the cost of fixing the same problems after the system is implemented [3]. Plan to correct observed problems, where possible, through redesigning the UI rather than alternatives, such as changing the training methods or simply expecting users to work around problems on their own.

Conduct Planned Iteration Among Procedures

Plan ahead to iterate and work through UI development in a cyclical fashion. The idea of purely sequential, or *waterfall*, development is not

TABLE 3

USER TESTING IN AN APPLE II ON-LINE TUTORIAL (TOGNAZZINI, 1992)

User Test	Screen Display	Failure Rate	Explanation for Failures
1	Color graphic is displayed *Prompt:* "Is the picture above in color?"	Overall: 25%	Users didn't know whether monitor was black and white or the color was turned off.
2	Color graphic of words GREEN, BLUE, ORANGE, MAGENTA is displayed with each word in the named color *Prompt:* "Are the words above in color?"	Color monitor 0% B/W monitor: 0% Green monitor: 100%	Users of green-screen monitors saw a green colored graphic.
3	Same graphic as User Test 2 *Prompt:* "Are the words above in more than one color?"	Color monitor: 0% B/W monitor: 20% Green monitor: 100%	Users of non-color monitors interpreted the graphic as two colors (black and white or black and green)
4	Same graphic as User Test 2 *Prompt:* "Are the words above in several different colors?"	Color monitor: 0% B/W monitor: 20% Green monitor: 25%	Users misread question as "Are the words above ... several different colors?"
5	Same graphic as User Test 2 *Prompt:* "Do the words above appear in several different colors?"	Overall: 0%	No failures.

appropriate for UIs [6]. Regardless of the amount of planning that may go into requirements specification, unexpected problems are typical in UI development. This is illustrated by the case of Apple UI developers who, in testing an on-line tutorial, found that their anticipated trouble spots were easily remedied, but a different, unforeseen problem in configuring the software to run with the users' monitors required a surprising number of observation cycles to remedy (see Table 3). The importance of planned iteration to their project is apparent in this quote:

> No matter how many engineers we had crowded into a room to discuss what areas users were or were not going to have trouble, we would never have hit upon this as the major problem in the application. Had we not tested, we would have had a disaster on our hands...My experience with this and other applications and systems have proven to me beyond a shadow of a doubt that testing can save time, rather than cost time because I don't have to work on things that aren't broken. [15, p. 89]

Iteration should be anticipated in UI development, especially between the observation and visualization stages where iterative cycles can refine the system prior to complete construction. Coupling a streamlined documentation process, fast visualization, and inexpensive observation with modern RAD programming environments can take much of the onus out of iteration and can significantly improve final products.

Moving from a sequential to an iterative process design can make it difficult to know when pre-release development is completed. We suggest the following guidelines to assess completion. First, review documentation of UI constraints and ensure that each has been addressed satisfactorily. Second, review the UI design to ensure that it conforms to the operating system standards for UI. Finally, address problems observed in testing a representative sample of users. The number of users that are observed should be weighed against the cost and difficulty of correcting problems that are discovered after the project is released.

DISCUSSION

Our presentation in the present paper has several limitations. First, the procedures have been tested in the classroom in only a limited number of occasions to date. Potentially, they will be refined and improved through future testing. Second, the presentation is informal and lacks statistical rigor, particularly in the observe procedure, where a substantial literature exists. However, the time constraints under which UI development must be covered in IS classes limits instructors to discussing only a small subset of the tools and techniques that are used regularly by HCI specialists. Thus, our presentation is not intended as a substitute for specialized training or to replace sophisticated HCI practices in situations where the highest level of UI development is a critical success factor, e.g., commercial software development. Finally, the importance of the procedures we have described must be weighed against external factors. For example, advice to leverage users' skills may be subordinated by the organizational goal of reengineering business processes to improve efficiency.

We propose that these limitations are offset by practical value provided to IS students who must draw initially upon their classroom training when called upon to develop UIs later in their careers. Our presentation describes a well-grounded set of procedures that can be applied to UI development in a systematic process. As students gain experience, it should not be necessary for them to replace these procedures with completely different methods. Since the procedures implement key aspects of HCI research and pedagogy, students with an interest can build upon them with knowledge that they gain through experience and further study.

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PEER LEARNING IN AN INTRODUCTORY PROGRAMMING COURSE

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The role of Information Systems within organizations is constantly changing. Undergraduates concentrating in Information Systems need to acquire the knowledge and skills to compete in this dynamic arena. The undergraduate curriculum must not only address technical knowledge but also communications and collaborative skills necessary for participation in the work environment. In order to provide an opportunity for students to combine these competencies, peer learning exercises were incorporated into an introductory programming course.

Peer learning techniques were combined with the standard methods of teaching computer programming skills. These techniques allow students, as peers, to learn from and with each other. Student learning is promoted through peer/classmate interaction within a formal team setting. Learning occurs, not only from the instructor, but from and with other students. Most peer learning exercises challenge the student to assume more of the learning responsibility.

This paper describes the use of peer learning exercises in a required undergraduate programming course. Peer learning techniques were implemented throughout the semester through small in-class group exercises and a larger final group programming project. This sharing of knowledge and group interaction created a better environment for learning subject matter that is often considered very difficult. Students enjoyed working with each other and their level of anxiety decreased. Although the focus of this paper is on a specific course, many of the activities can be implemented in other technical or non-technical courses.

INTRODUCTION

The role of Information Systems within organizations is constantly changing. Undergraduates concentrating in Information Systems need to acquire the knowledge and skills to compete in this dynamic arena. The undergraduate curriculum must not only address technical knowledge but also communications and collaborative skills necessary for participation in the work environment. In order to provide students the opportunity to combine these skills, peer learning exercises were incorporated into an introductory programming course.

Two different student populations enroll in this semester-long course. First, all undergraduate students in the Information Systems field within the School of Business and Public Management at The George Washington University are required to take this as the first course in their field of concentration. Second, all graduate students admitted to the Masters of Science in Information Systems program who do not have programming knowledge background for more advanced Information Systems material are also required to take this course. Therefore, this course is a prerequisite to all other Information Systems courses at the undergraduate level and almost all those at the graduate level. As such, it provides a foundation for future Information Systems courses. However, it is felt that the course can also increase communication and collaborative skills as well.

Peer learning techniques were combined with the standard methods of teaching computer programming skills. These techniques advocate students, as peers, to learn from and with each other. Student learning is promoted through peer/classmate interaction within a formal team setting. Learning occurs, not only from the instructor, but from and with other students. Most peer learning exercises challenge the student to assume more of the learning responsibility. Additionally, as students work with their peers in the problem-solving exercises, they improve their communication and collaborative skills.

Since the course's student population is a hybrid of undergraduates and graduates, participants have an opportunity to work with individuals from different age groups and varied work experiences. In addition, due to the ethnically diverse student population, students have a multi-cultural experience. Peer learning techniques were implemented through semester long small in-class group exercises and a larger final group programming project. All phases of programming were addressed - from the initial design to debugging written code.

Students in programming classes are usually required to work independently on their projects with stiff penalties for collaboration. However, software development teams within organizations work collaboratively in the design and coding of the programming project. Additionally, since there is often more than one way to problem-solve, it is beneficial for students to share their initial ideas and incorporate alternative solutions into their system design. Similarly, students are encouraged to help each other debug code. This sharing of knowledge creates a better environment for learning a subject that is often considered very difficult. Students enjoy working with one another and their level of anxiety decreases. Although the focus of this paper is on this specific course, many of the peer learning activities are appropriate for other technical or non-technical courses.

WHY PEER LEARNING?

A 1996 Worcester Polytechnic Institute (WPI) workshop sponsored by the NSF brought together computer science and information systems (CS/IS) educators for a two year project. The purpose was the exploration of and adoption of peer learning into the introductory CS/IS curriculum. Within a peer learning setting, and implementing peer learning exercises, workshop participants developed cooperative activities suitable for inclusion in their own classes. Participants were randomly assigned different teams for each in-class task. After each project was completed, outcomes were shared. Pros and cons of the development process were discussed. The process was more important than the outcome: participants wanted to understand and experience the dynamics of peer learning. Because peer learning techniques were implemented during the workshop, not just discussed, participants acquired peer learning skills through peer learning activities - a practice what you preach approach. The WPI workshop goals were to:

- "develop cooperative activities,
- disseminate the use of peer learning techniques to other faculty and schools who are currently using more traditional classroom approaches, and
- build on the experience of faculty who are using peer learning, and evaluate the effectiveness of using peer learning techniques across different educational environments." (Wills 1996)

Peer (or cooperative) learning fosters students working together as part of their own learning experience (Wills 1996). The traditional role of the instructor is expanded to include facilitation and coordination of the student groups. Students are responsible for working together toward the task completion and therefore assume greater responsibility for their own learning.

According to Rau and Heyl (1990), students who are involved with information social relations learn more than those not engaged in similar activities. Bok (1986), in his report on higher education, suggests that active discussion in the classroom provides students diversified opportunities to reason through challenging problems. Recent AACSB guidelines (1993) emphasize team building and collaboration as a powerful learning experience. Dutt (1994) suggests that short term self-directed projects place the responsibility for learning on the students. Lippert and Granger (1996) provide examples of peer learning exercises introduced into the undergraduate curriculum.

Groccia and Miller (1996) use of Peer Learning Assistants (PLA) to facilitate the peer learning process in large class settings included a cooperative learning format. Their course design emphasized small group problem solving exercises replacing lectures and tests. Hart and Groccia (1994) suggest in-class student teams, informal gatherings of three to four students, or formal gatherings to create a collaborative environment for problem solving. Hunter (1994) indicates that cooperative learning activities show slight benefits including increased student problem-solving skills and an ability to work in groups.

Due to the perception that the introductory programming course encompasses a difficult subject to master and there is a great deal of required work, the course was selected for revision with the peer learning model. It was felt that since this course is the prerequisite for the rest of the undergraduate and graduate Information Systems curriculum, if students could improve their problem-solving, communication and collaborative skills, they would perform at a higher level in subsequent courses. Additionally, it was an attempt to make the course more interactive, less threatening, and more enjoyable.

COURSE BACKGROUND

The course selected to implement peer learning is a 14 week introductory computer programming and data structures course offered every semester. Class size is generally between 20-28 students, however in-class peer learning exercises are appropriate for almost any size class. The course consists of two components: a two hour lecture and a two hour laboratory. The lecture focuses on standard introductory programming material found in many of the typical textbooks. Students receive weekly homework assignments designed to reinforce their theoretical understanding. Students also work on weekly hands-on programming projects in the laboratory under the guidance of a graduate teaching fellow. A midterm and final examination test for understanding of theoretical concepts.

Peer learning techniques are introduced the first day of class. As an ice-breaker, students provide information about their major, year in school, computer background, and one interesting fact that others might not know. This is just one example of an ice-breaker that might be used. Each week, the majority of the class period consists of the traditional lecture method using presentation overheads. Peer learning exercises are implemented at the end of each class and in a larger project during the last 4 weeks of the semester.

WEEKLY PEER LEARNING EXERCISES

Before the peer learning model is utilized in the classroom, the instructor describes the guidelines by which the peer learning techniques are utilized. Student teams of three members are used each week for the peer learning exercise. Peer learning techniques advocate the use of student roles within small group exercises. In teams of three, students rotate into different team roles of moderator, scribe, and presenter. The role of the moderator is to facilitate the process. If the group becomes stuck on a particular aspect of the exercise, the moderator suggests alternative approaches to answer the problem. The role of the scribe is to record the results or output of the exercise so that the presenter may use the results in presenting the group's work to the class.

Students are encouraged to actively listen to one another and show respect for each other's opinions. Each week, students are randomly assigned to three-member teams, thereby enabling them to work with different class members. Students work with people of different technical backgrounds, work experience, and interpersonal capabilities and the weekly peer learning exercises require them to respond to new group members, new group dynamics, and new learning possibilities. Student roles are changed each week. Students are encouraged to assume a new role, moderator, scribe, or presenter, each week. Varying team composition forces interaction with many of the students in the class, not just their friends or those with whom they feel comfortable. In order to endure this diversity in the teams and that each student has the opportunity to work with all other students, the instructor may predetermine and assign the team composition at the beginning of the semester.

Students, in their randomly assigned teams-of-the-day, have 10-20 minutes to complete the week's exercise. Some weekly exercises include program traces showing the flow of data through program segments or individual modules, while others include establishing a variable declaration section for the program. In another week's exercise, students may write a small 20 line program. Others address debugging issues. As more complex course material is introduced, students receive program segments with one of the following errors: syntax errors, run-time errors, or logic errors.

To ensure inclusive student participation, the instructor walks around the room and reviews work in progress while offering encouragement and suggestions. This enables the instructor to assist groups experiencing difficulties and, in addition, observe the contribution level of the students. A more formal way of evaluating participation involves feedback, often written from each team. This strategy was not implemented in this instance: the informal evaluation is a low-key approach and less threatening to the students who concentrate on the task and not the grade. The instructor reviews each completed exercise and, if errors exist, informs the team how many errors are present and encourages the members to try to resolve the issues.

The first group correctly completing the in-class exercise places the results of their collaboration on the blackboard. The presenter within that group explains the logic, the process by which the results were determined, and areas where difficulties were experienced. Discussion is opened to the class. The instructor offers additional guidelines for the presentation aspect of the peer learning exercise. Constructive criticism of the solution, beneficial to both the group and the class is acceptable. Comments such as 'that is no good' are unacceptable, as are any comments attacking the 'authors' of the solution. Only the work product can be evaluated and suggestions for improvement are encouraged. Depending upon the task, the question answered may be:

- Is the output right?
- Was the correct error located?
- Is the code generated feasible? Can it be improved? How?
- Is the code efficient? Can the quality of the code be improved? How?

Although either the type of task or the instructor dictates the relevant question, at this point, the instructor attempts to remain out of the discussion. The instructor is not viewed as a 'peer' and any input is usually construed as 'the right' answer. Some students are intimidated by the instructor's comments, even perceiving them as threatening. The role of the instructor is one of facilitator and recorder of the comments. At the end of the class discussion, the instructor may offer overall observations or suggestions. Observations may include areas where several groups experienced difficulty in completing the exercise. Suggestions for alternative logical approaches might be offered. Observations might include suggestions for improved group participation and interaction.

These peer learning exercises enable students to acquire problem solving abilities and knowledge while developing skills in group dynamics. The changing of team roles enables students to approach problems through different participatory functions. Effective communication skills and collaboration are also nurtured through the peer learning exercises. Students must communicate their ideas and strategies for problem solving with others from diverse cultural backgrounds and different programming or work experience. In this class, the age difference and the graduate-undergraduate melange should not overwhelm the undergraduate student or create a superiority complex in the graduate student - they are peers and need to work together with that understanding. The diverse mix of individuals represents the dynamics students might face in typical programming work group within industry-based organizations. These exercises facilitate teamwork and the weekly repetition strengthens problem-solving competencies. These are necessary skills for success in an Information Systems career.

During the last 4 weeks of the semester, a longer term collaborative work is assigned. This programming project is produced independent of the class lecture and laboratory time. It is an opportunity for the students to further hone those skills learned during the in-class peer learning exercises.

THE PROGRAMMING PROJECT

Students selected teams of three. The weekly in-class peer learning exercises enabled students to become familiar with their classmates' problem-solving capabilities, communication skills, and collaboration techniques. Using this knowledge, the programming project teams are able to make more informed decisions regarding the distribution of responsibilities. A goal for students is to recognize the strengths of their fellow team members and to not only utilize these strengths in the completion of the project but to learn from them as well. Although studies have shown the outcomes from self-selected teams are less creative and of lower quality than those determined by the instructor, students still prefer selecting the teams themselves. In this instance, the outcome of the 'more informed team selection' resulted in slightly higher quality of projects. However, the instructor would randomly assign students to teams in the future or select members based on previous programming experience.

The programming project consists of two phases: pseudocode development and system design implementation. During the first two week phase, students develop pseudocode for the system. Each team's pseudocode is critiqued by the professor. Logic weaknesses are identified and alternatives are suggested. In order to facilitate student thinking about particular sections of their pseudocode, detailed comments are provided. Students are encouraged to begin coding less complex sections of code–those concentrating on output formats and headings.

During the system design implementation phase, students code their design. Although this phase lasts two weeks, is it expected that students began coding during the initial phase. Another peer learning strategy involves the exchange of designs. Teams then code another team design. However, given this course's time structuring, there is not enough time to thoroughly analyze and comprehend a second design. This strategy introduces another aspect of peer learning-collaboration between teams, not just individuals.

During the last class, teams present their project output. Students discuss their system development methodology, their coding methodologies, and why they chose a particular design for the system. This forces the students to think through the process and organize their understanding into a cohesive presentation. It also allows students to learn from each other and to view other methods for solving the problem, using innovative code and presentation techniques. This part of the project reinforces their communication and collaborative skills learned in earlier exercises.

EVALUATIONS

Students evaluate each member's performance during the project. Not only do they evaluate their team member's performance, they also evaluate their own effectiveness. Groups are allocated one hundred points per group member. With three people per team and three hundred points, students allocate the points to each group member for several different evaluation categories. Categories of evaluation include contribution to the pseudocode development, problem-solving strategies, design methodologies, code generation, final product assimilation, and proper presentation of output. The quality of the evaluations themselves becomes part of the student's grade and has some effect on team members' participation grade.

Students also discuss the influence of the peer learning experience on the development of the project. Guidelines for discussing the peer learning experiences are provided. Students are instructed to observe team dynamics and attempt to understand what worked well within the groups and what did not work well. Groups are encouraged to discuss the process openly. Anecdotes relating to team interactions are shared as learning opportunities for everyone in the class. The students know this feedback will be used in future classes to improve the peer learning experience. Teams are required to share one personal narrative - a team misjudgment - and explain how to handle the situation differently. Students need to understand that this is a learning experience and they should neither be embarrassed nor make fun of others.

The project serves three purposes:

- it enables students to integrate theoretical knowledge and hands-on programming skills in a larger project.
- it enables students to use peer learning techniques in the development of a project.
- it enables students to integrate team-working skills, problem solving knowledge, systems development methodology, and communication skills.

LESSONS LEARNED

Integrating peer learning exercises requires additional instructor time. The instructor must not only restructure lecture time, but also develop peer learning exercises that can be utilized during each class. The exercises should be challenging enough but are time-restricted for administration during a 10-20 minute time period. However, feedback from students regarding the project and the peer learning experience is positive. On a recent evaluation form a student wrote, "I enjoyed the weekly in-class exercises. I learned more working with my group members. It was fun."

The instructor observed that toward the end of the semester, students appeared more willing to ask questions during the peer learning exercises. Students who were experiencing difficulty indicated a lack of understanding by directly asking for clarification from their group members. Group members provided explanation to one another. Groups also ask questions that the individuals themselves do not ask.

There are several recommendations for others attempting to use weekly peer learning exercises in the classroom. First, require students to physically move to another location in the classroom. Students tend to stay in their current location and work with their friends. The physical act of moving students from one side of the room to another appears to rejuvenate their attention and interest in the exercise. It may simply be that the act of walking restores circulation, but there is an observable difference in the attention level when students are required to change locations and teammates.

Second, ensure gender mixing of your groups. The first several weeks students tended to remain in gender similar groups. The instructor noticed the all male groups spoke louder while the all female groups appeared less vocal and less connected to the exercise. When the all female groups were separated, the less vocal females became slightly more vocal in the mixed gender groups. One female student in particular, who in the all female group tended to remain passive, became slightly more active when she was the only female in the group.

Third, change groups every week. The first three weeks the instructor suggested that individuals change groups. However, not all students complied, preferring to work with their friends. The instructor noticed an attitude of indifference developing within those teams' members. Once the instructor required the composition of the teams to change weekly and insisted that all students physically move to another location, the level of interaction increased. Since students appeared to avoid changing team members, this process needs to be facilitated. The students can self-select teams, as they did in this class or the teams can be assigned each week. One way of assigning teams is to actually develop a matrix that controls the mix of the students each week. Another way, more random, is to assign difference numbers to students each week and form team composition based on these numbers.

The feedback from students is positive. Both the laboratory programming grades and weekly theoretical homework assignment are slightly higher than in previous semesters. There are plans to incorporate a structured evaluation process of the weekly exercises. The quality of work was slightly higher than past semesters. Students are more actively engaged in the learning process then the lecture process. The in-class exercises created a less threatening team environment as the students moved to the larger team programming project.

FUTURE PLANS

The use of peer leaning techniques will continue to be implemented in this course as well as other undergraduate information systems courses. In-class peer learning exercises are being developed that incorporate the design of data flow diagrams, structure charts, entity relationship diagrams, normalization issues and converting entity relationship diagrams to normalized relations. Used at the end of a class lecture, they effectively reinforce the lecture topic and highlight immediately any concepts students do not comprehend.

SUMMARY

As mentioned, developing these exercises creates additional work for the instructor. However, it is felt that as the students accept more responsibility for their own learning, they acquire an appreciation for not only the required course material, but for their own capabilities. Some students perceive computer programming as dry, boring and very tedious. However, the peer learning exercises engage the students in the learning process and make the material more appealing. Class participation increased and students, in general, tended to ask more questions than prior semesters. They appeared more interested in the entire experience. While there are many factors that might have caused this observable difference, it is felt that the additional instructor time and involvement was rewarded with more receptive and enthusiastic students.

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BEYOND COURSE AVAILABILITY: AN INVESTIGATION INTO ORDER AND CONCURRENCY EFFECTS OF UNDERGRADUATE PROGRAMMING COURSES ON LEARNING

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INTRODUCTION

The process of undergraduate MIS education is constantly evolving. As educators, we find ourselves in a constant state of curriculum redesign, often to meet the demands of the various recruiters that visit our campuses each Fall looking for new talent in the expanding field. Quite often, these new technologies are programming languages. It is common today to hear recruiters ask for students skilled in C++,Visual Basic, Powerbuilder, or Java before entering the job market. In accordance with Association for Computing Machinery (ACM) curriculum design guidelines (ACM 1991), we incorporate these technologies into our curriculums, keeping the content as current as possible. However, in the rush to design our curriculums to give students maximum exposure to required technologies, perhaps we overlooked factors to maximize learning efficiency in our students.

A debate exists today over the proper method of programmer instruction. Research has been conducted in the past to find the optimal sequence for offering programming instruction. Veteran programmers learned the older second and third generation languages (2GLs and 3GLs) before they learned 4GLs because no 4GLs existed. Students now are often afforded the opportunity to learn a 4GL or object-oriented programming language without ever learning a 3GL. Empirical research in the past has found mixed results (Manns and Carlson 1992, Rosson and Alpert 1990), while authors have made claims for first learning the object oriented language (Currid 1992) and for first learning the 3GL (Powell 1997).

Moreover, students often find themselves in a crunch to get registered for the required courses. With the undergraduate MIS major's increasing popularity, it is getting harder for the students to arrange their schedules' optimally. It is not uncommon to find students taking two or three different programming languages during the same semester. The authors find it difficult to believe that a student can perform optimally under these conditions, as this would be like a student trying to learn two spoken foreign languages, like French and German, during the same semester.

Given the apparent mentioned conflicts, the objective of our study was to find the answers to 2 primary research questions:

1) Do students learn languages better when they are offered in a particular order, such as 4th Generation Languages (4GL) before 3GL's or vice versa or is there no effect?

2) Do students learn programming languages better when they are taken in separate semesters as opposed to simultaneously?

In an attempt to find the answers to these questions, we decided to ask the students themselves. In the classroom, programming instructors hear a variety of complaints from students regarding their difficulty or inability to learn the language at hand. We divide these comments in two groups. The first group is from students who have learned a prior language and are having difficulty learning a second language. Often they are attempting to learn two programming languages at the same time. This is the group we call "But there's an easier way....." The other group are students that have never had any programming courses before. They tend to report in the classroom that they feel inferior to other students in the class who may know more about computers or be more experienced with programming. They are worried that their objective performance in the class will suffer because they are being compared to this other group of students. This group we call "It's not fair....."

Based on experiences noted in the classroom, we formulate the following hypotheses:

H1a. Students that have a prior experience with a programming language will have higher grades in an introductory course in that language than those who have no prior experience with that programming language.

H1b. Students that have taken any programming class will have better grades in a course than those who have not taken a programming class.

H1c. Students who are taking more than one programming language simultaneously will have worse grades than those who have taken the same programming languages in any non-simultaneous order.

We use grades in H1 because they are intended to be an objective measure of performance. However, there are often other factors than mastery of the skill which figure into the awarding of grades. These often include attendance, year of progression through school, and some factor of general intelligence. Therefore, we also propose:

H2a. Students who attend class more regularly will have higher grades in programming courses than those who do not attend class regularly.

H2b. Students who have higher grade point averages will perform better in a programming course than those who have lower grade point averages.

H2c. Students who have progressed further in school will have higher grades in programming courses than those who have progressed less in school.

We would still like to get another dependent measure of mastery of the skill. While objective measures are important in science, a subjective measure of mastery may also be important. Students may make a high grade in a course but not have any mastery of the material, and vice versa. Therefore we propose level of comfort as a dependent measure for student mastery of programming material.

H3a. Students that have a prior experience with a programming language will feel more comfortable with that language than those who have no prior experience with that programming language.

H3b. Students that have taken any programming class will feel more comfortable with the language than those who have not taken a programming class.

H3c. Students who are taking more than one programming language simultaneously will feel less comfortable with the languages than those who have taken the same programming languages in any non-simultaneous order.

METHODOLOGY

Students from nine introductory programming classes over two semesters at a large Midwestern university were used as subjects for this experiment. 275 students responded to a survey at the end of the semester. This was done without compensation to the students, requiring a few minutes of their time at the beginning of the class. One response was determined to be unusable and it was discarded. Subjects were also asked that if they had completed this survey in another class to indicate this at the top of the page, and 19 surveys were eliminated through this method.

The survey asked students to respond to several items concerning their academic performance and relative comfort with the language. Students responded anonymously to remove threats to internal validity (Campbell and Stanley 1963). These items covered objective performance levels, such as grading, and subjective performance, including comfort with the language and desire to learn more about the language. Subjects reported not only on the class they were currently finishing but also on all other programming classes they had taken for a grade at the collegiate level or above. This was done to capture data about all their classes for determination of ordering effects.

Subject responses were divided into three groups, depending on the class being rated. These classes were introduction to Visual Programming, introduction to COBOL programming, and introduction to C programming. This of course meant that the same subject may have been in each of the three pools if she or he had taken all of the courses being examined. These groups were analyzed individually and then compared to the others for significance. Linear regression was used with the same covariates against two different dependent variables, grade in the course and comfort level with the language. Reported prior experience was also captured as a Likert scale and used as a covariate.

RESULTS AND INTERPRETATIONS

To test our hypotheses, we used linear regression, running the data against two separate dependent variables, grade and comfort factor. As noted above, grade was the self reported letter grade for the student for prior classes and expected grade for the current class. This was then converted into the numeric equivalents at that university. The data set was also divided into three partitions, depending on the class being rated. Since attendance was expected to have only a significant influence on grade rather than comfort level, they were only suggested as hypotheses when grade was the dependent variable. We inserted the variables for H2 into those regressions anyway for the reader's benefit.

1. *Dependent Variable = Grade*

   A. *Class Rated = Introduction to Visual Programming using Visual Basic*

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	S.E.	Beta		
(Constant)	.560	.537		1.043	.299
W-COBOL	-.359	.420	-.062	-.856	.393
W-C	.176	.119	.115	1.483	.140
H-COBOL	<.001	.126	.069	.750	.454
H-C	<.001	.121	.075	.793	.429
Attendance	.151	.050	.223	3.053	.003
PriorExp	<.001	.035	.213	2.822	.005
GPA	.397	.123	.234	3.242	.001
YrInColl	<.001	.065	.048	.615	.539

   B. *Class Rated = Introduction to COBOL programming*

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	S.E.	Beta		
(Constant)	1.322	1.006		1.315	.195
W-VB	.195	.464	.050	.421	.675
W-C	-.164	.220	-.092	-.746	.459
H-VB	-.281	.374	-.099	-.750	.457
H-C	-.159	.235	-.095	-.677	.501
Attendance	-<.001	.098	-.066	-.525	.602
PriorExp	-<.001	.089	-.092	-.731	.468
GPA	1.183	.243	.605	4.876	.000
YrInColl	-.315	.167	-.246	-1.890	.065

   C. *Class Rated = Introduction to C programming*

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	S.E.	Beta		
(Constant)	.549	.447		1.229	.221
W-VB	.276	.105	.170	2.635	.009
W-COBOL	-.297	.162	-.117	-1.834	.068
H-VB	<.001	.128	.046	.743	.458
H-COBOL	<.001	.103	.013	.196	.845
Attendance	<.001	.045	.112	1.724	.086
PriorExp	<.001	.024	.185	2.901	.004
GPA	.753	.102	.484	7.356	.000
YrInColl	-<.001	.056	-.023	-.334	.739

It is interesting that we find different results for the different types of classes. This would support the mixed results that we have seen before. For the visual programming courses, we find grades are in no way related to any other programming language work. Attendance, Prior experience, and GPA are the only significant factors affecting grade, supporting **H1a, H2a,** and **H2b**. We fail to reject the null hypothesis for **H1b, H1c**, and **H2c**.

With the course in COBOL, however, we get different results. The only significant predictor of grade is GPA, supporting **H2b**. It is interesting that **H1a** is not supported, perhaps giving credibility to the notion that grades and mastery are not perfectly related. Perhaps even more significant is that year in school is marginally significant (p=.065), in the opposite direction, suggesting that students who are further along in school will perform worse in COBOL. This may be evidence for the term "senioritis", suggesting that students may slack off on their studies as they get closer to graduation.

Finally, the Introduction to C programming course gives even different results. **H1a** is supported, confirming that those who have prior experience will earn a better grade. Taking the course with the visual programming course improves their grade in C, completely opposite of **H1c**. However, taking the course with COBOL is marginally significant (p=.068), supporting **H1c**. This is especially interesting given that C is more closely related to COBOL than it is related to Visual Basic. **H2b** (GPA) is also supported, and there is mild support (p=.086) for attendance improving grades.

2. Dependent Variable = Comfort Level

A. Class Rated = Introduction to Visual Programming using Visual Basic

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	S.E.	Beta		
(Constant)	3.223	1.038		3.106	.002
W-Cobol	.983	.664	.107	1.481	.140
W-C	.536	.223	.188	2.407	.017
H-Cobol	.387	.244	.146	1.586	.115
H-C	.169	.234	.069	.721	.472
Attendance	<.001	.096	.052	.705	.482
PriorExp	.158	.067	.178	2.350	.020
GPA	<.001	.237	.016	.220	.826
YrInColl	.142	.125	.089	1.142	.255

B. Class Rated = Introduction to COBOL programming

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	S.E.	Beta		
(Constant)	4.572	2.074		2.204	.032
W-VB	.479	.798	.081	.601	.551
W-C	.234	.458	.073	.510	.612
H-VB	-.281	.779	-.055	-.360	.720
H-C	.632	.461	.218	1.369	.177
Attendance	.245	.200	.175	1.225	.226
PriorExp	-<.001	.186	-.011	-.077	.939
GPA	-<.001	.498	-.015	-.103	.919
YrInColl	-.346	.347	-.150	-.998	.323

C. Class Rated = Introduction to C programming

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	S.E.	Beta		
(Constant)	.560	.537		1.043	.299
W-VB	.674	.194	.231	3.476	.001
W-Cobol	-.725	.325	-.148	-2.232	.027
H-VB	.686	.281	.160	2.442	.015
H-Cobol	<.001	.221	.017	.244	.807
Attendance	<.001	.097	.028	.406	.685
PriorExp	.183	.053	.230	3.449	.001
GPA	.299	.212	.096	1.408	.161
YrInColl	-.103	.112	-.065	-.927	.355

Again in examining the Comfort variable, we get mixed results. These results also tend to be different from those using grade as a dependent variable, lending more credibility to the notion of grades and mastery being mildly correlated. In the Visual Programming class, **H3a** is supported, which may suggest that one semester of a visual programming course is not enough to bring novices on a par with more experienced users. We were again surprised to find that **H3c** was supported in the opposite direction than we suspected, as increased comfort level was reported from those who took the two classes together.

In the COBOL course, we find nothing significant. None of the variables we captured were predictors of a person's comfort level with COBOL.

The lack of support for many variables in the COBOL course in both situations may be due to a lack of power. There were far less students who had taken the COBOL course (56) than the C course (191) or the Visual Programming course (173).

Finally, in the C course, we have a third set of results. In line with the Visual Programming course, students reported a higher comfort level if they were taking the course concurrently with visual programming, providing opposite support for **H3c**. The more expected result was found from students who were taking C with the COBOL class, supporting **H3c.** **H3b** was also supported with the Visual Programming course, but it was not with the COBOL course. This was the only instance where either **H1b** or **H3b** was significant. Prior experience was also significant, supporting **H3a**.

CONCLUSIONS AND FUTURE RESEARCH DIRECTIONS

As we noted in our results section, the findings we had with the data were very mixed. No single hypothesis was supported across all classes when Comfort was the dependent variable, and only GPA was supported consistently as a predictor of Grade. These mixed results are not necessarily bad, however. They help us in curriculum design, which was the goal of this paper.

The Introduction to COBOL course was the one which had the least predictors for either dependent variable. GPA was the only predictor of Grade, and there were no predictors of comfort level. This can be interpreted to mean that nothing gives anyone an undue advantage in the COBOL course. Beginners are just as likely to do well in the course as are experts. Thus we can suggest Introduction to COBOL as the first programming course in the programming sequence.

Secondly, we noticed that students seemed to perform better in the C course when they had already taken or were currently taking the visual programming course. This did not hold true in reverse. Thus we can suggest that students should take visual programming first, and then a course in COBOL.

FIGURE 1

Suggested Order of Courses:

1. COBOL
2. Visual Programming
3. C

More research should be done to try to discover the reasons for the contrasting results. For example, it is not clear to the authors why students seem to perform better when taking C concurrently with visual programming but worse when taking it with COBOL programming. We cannot explain these effects and would like to try to investigate them further. Exploration into student experiences with taking concurrent programming languages would also help, at least on a exploratory level. Perhaps comparing them to students who have attempted to learn two foreign languages simultaneously would help discover learning and memorization patterns.

Moreover, we are unsure how this research applies outside university settings. It would be interesting to survey professional programmers in the same manner. Professional training courses could be used to find programmers of different ability and style.

Overall, this research is of interest to researchers in one of our forms of patronage to society, educating students. We owe it our students (and often our taxpayers) to help them as much as possible in the education process. Finding the optimal way to deliver that education is part of our responsibility.

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WHAT MOTIVATES TODAY'S INFORMATION SYSTEMS GRADUATES?

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Hiring is an enormous challenge in today's I/S organizations due to the heavy demand for graduating I/S students. This paper reports on a study to determine what factors I/S students consider important in evaluating potential employers. The survey results show graduating I/S students most prefer a work environment that involves fun, self-gratifying work in a friendly environment. They primarily target jobs that provide growth, learning, and professional development opportunities, and jobs that provide opportunities to work with leading edge, emerging technologies.

INTRODUCTION

Good news for today's I/S students. There is a heavy demand for their talents. While demand for information systems and related competencies continues to grow the supply of fresh talent has been relatively flat or declining for many years. This suggests that strong demand for I/S graduates will continue unabated for the foreseeable future (Alexander 1996). Although strong demand is prompting the escalation and publicity of high salary and benefits, it is important for students to realize there is more to a satisfying job than just the monetary aspects.

Strong demand for I/S talent is "bad news" for companies needing to hire today's hot I/S recruits. Recruitment is becoming more difficult as you encounter strong competition from other firms who are after the same top recruits whom you are trying to lure (King, 1997a). Companies are increasingly experiencing I/S staffing problems as the worldwide pool of I/S talent is being stretched beyond capacity (King, 1997c). Yet your organization needs to succeed! Perhaps by understanding the motivating factors that entice today's recruits your firm can be more successful in landing and retaining prized talent.

THEORETICAL FOUNDATION

Theories of motivation suggest the motivators and satisfaction of people progress from attempts to satisfy basic needs to attempts to satisfy higher-order intrinsic needs (Herzberg 1987; Maslow 1954). Basic needs, or hygiene factors such as salary and job security, are extrinsic to the job and lose their motivating capacity once a base level need is satisfied. High-order intrinsic needs are based on successful achievement of meaningful tasks, recognition, and self-fulfillment; these factors continue to motivate and satisfy beyond any base level.

In addition to enabling job satisfaction, motivators also stimulate organizational commitment (Steers and Porter, 1991). Furthermore, retention of I/S workers is influenced by job satisfaction and commitment (Igbaria and Greenhaus, 1992; Scheier, 1997). Thus, job attractiveness may initially be influenced by salary and benefits, but ultimately satisfaction, commitment, and retention will be influenced by challenging, meaningful work and other job characteristics that target intrinsic motivators and higher order needs (Couger and Zawacki, 1980). Both the employer and the recruit are better serviced if they can identify a working environment that will be fulfilling and satisfying to the new I/S worker, and thus lead to longer term employment and productivity.

CAREER STAGES

According to Career Development Theory (Super 1953, 1980; Schein, 1978), a typical person is perceived as progressing through four career stages (footnote: according to Super there are five life-span stages; however, the Growth Stage is pre-career encompassing childhood, elementary, and junior high school ages). The four general career stages are 1) the Exploration Stage or career preparation; 2) the Establishment Stage involves job seeking and early career job assignments, 3) the Maintenance Stage or mid-career where productivity peaks, and 4) the late career Disengagement or Decline Stage and planning for retirement. In passing through each stage the person evolves their career competencies, expectations, aspirations, and motivations. The same job holds different meanings for two people who live in differing situations. What is important to a person in late career may seem irrelevant to someone who is just beginning their career. For example, a retirement pension plan may not significantly inspire a 22 year old college graduate, and constant re-tooling may not inspire someone who is impatiently approaching retirement. The research described in this article focuses on graduating college students who are completing career preparation and transitioning toward the career establishment stage.

EMPLOYER PERSPECTIVE

Due to rapid organizational and technology changes, the computing professions provide significant opportunities for early career employees. Organizations are recognizing the strategic importance of information, rapid data access, and electronic forms of commerce and communications. This increasing importance establishes escalating demand for professional I/S services which are reportedly growing by 25% annually (King, 1997c). Today's employment market demonstrates high demand for many I/S competencies, especially current technology skills such as data warehousing, networking, object orientation, internet and client/server development skills. Many employers are vying for the same constrained resources and hiring the right person is becoming more difficult but also more important. To attract hot young talent with emergent technology skills the employer must understand what motivates I/S employees who are transitioning from the career Exploration Stage to the career Establishment stage. While several studies have examined what factors motivate I/S professionals in general, it is also important to understand which factors are most meaningful to recruits who are preparing for induction into their early career stage. Just as the success of a sports team is highly dependent on their recruiting efforts, the success of I/S organizations is also dependent upon successful recruitment (and retention) of talented staff. Understanding job preference factors should assist both in recruiting and in retention of these valued, scarce resources.

Research examining job attribute preferences has shown mixed results. For example, a survey including over 7000 respondents indicated the most preferred attribute to be meaningful work (50% selected as #1 attribute), promotion opportunities (20%), income and benefits (19%), job security (7%), and work hours (4%) (Lacy, Bokemeier, and Shepard 1983). Another large, multi-year study reported job security, type of work, and opportunities for advancement ranked as the highest job preference factors among working men (Jurgensen, 1978). In general, professional and technical people were found to be most strongly impacted by opportunities to perform "important and meaningful work" but with an alarming trend indicating that "high income" has been increasing in importance while meaningful work has been decreasing in importance (Weaver and Matthews, 1987).

Hiring is an enormous challenge in today's I/S organizations. Given that turnover can cost an organization up to two times the annual salary of a position, hiring right creates enormous benefits in terms of time, money, productivity, and reduced anxiety (Herman 1994). Successful recruitment is extremely important given the 15-20% attrition rate reported in many I/S staffs. Nonetheless, some companies are very successful in attracting new recruits while maintaining I/S attrition rates of under 2% (Gow, 1997).

STUDENT PERSPECTIVE

In thinking about recruitment and job selection, many students seem overly focused on salary comparisons as the crucial decision criteria. Whereas salaries are easy to measure, compare, and brag about, they are not necessarily prudent decision criteria. In fact, many of the "Best Companies" in I/S claim successful recruitment and retention using salaries that are competitive but not high (Gow, 1997). Similarly, a recent survey of current I/S professionals states that "pay isn't the top factor when weighing job offers" and that professionals are unlikely to jump ship provided their wage is reasonable and the work environment is favorable. A favorable work environment was characterized by a quality boss, the opportunity to work with new technologies and to learn new skills (Scheier, 1997).

Having worked many years in and near the computer industry we are aware that salary is only one of many criteria in deciding job and career satisfaction. Subsequently, we devote sessions in each senior course to the topic of career options and factors to consider during their job search. The current research was spawned by ongoing student discussions questioning what criteria should be important during their job search and company selection. Ultimately, each student must answer the question "what is important to me." To help students reflect on this question we conducted a survey of graduating seniors and masters degree students. This survey was intended to broaden their focus by seeing what factors other students had considered important in evaluating potential employers.

RESEARCH QUESTION

The primary research question addressed in this study is as follows. 1) What job preference factors do I/S students identify as being most important to them in pursuing, selecting , and accepting a job. 2) How do the important job preference factors as perceived by student recruits align with motivating factors as reported by I/S professionals overall.

METHODOLOGY

Initially using an open ended survey approach, 28 upper level I/S students were asked to identify what job preference factors were important to them in selecting companies and jobs. Factors identified in the initial open-ended survey were then analyzed and consolidated into common ideas. Common ideas were translated into survey statements and combined with statements extracted from the job motivation literature (Couger and Zawacki, 1980) to formulate survey items for a second closed-format survey. These items were subsequently rated by students using 9 point Likert-type survey scales to indicate to what degree the stated job characteristic would impact their job choice. The preference scales were bounded by "-4: Strong Negative Impact" and "4: Strong Positive Impact" with the scale mid-point represented by "0: No Impact."
This study reports and briefly interprets the findings of the survey results.

Subjects

The primary, closed-format survey was administered to a large population of seniors and graduate level I/S students at two universities. Surveys were administered during class time, participation was voluntary, and the completed survey forms were anonymous. Surveys were completed during November/December 1996 in an economic time-frame when the I/S labor market was entering a period of high demand. In total, 133 usable responses were collected. Fifty-five percent of the respondents were Bachelor degree seeking students. Ninety-two percent reported they would be graduating within the next year. The subjects were primarily male (61%) and full-time students (70%). Thirty-one percent of the students worked a full-time job and another 41% reported part-time employment.

Respondent samples are representative of two major U.S. universities. Fifty-five percent of the respondents attended SEU (a South-Eastern University) while the remaining 45% attended MWU (a Mid-Western University). Both universities are large state supported schools with large I/S related programs (over 500 majors in each program). SEU is located near a major metropolitan area and is attended primarily by commuter students. MWU is in a much smaller city (100,000 population) and is attended primarily by traditional residential students. Both areas have strong economies with tremendous demand for I/S graduates.

RESULTS

A total of fifty-two item statements were presented to obtain I/S student respondents job attribute preference judgments. The results are reported based on author categorization of survey items. The categories are influenced by the literatures on job preferences and job motivation (job characteristics).

Table 1 illustrates descriptive statistics related to extrinsic job characteristics such as Job Security, Opportunities for Advancement, and Pay & Benefit items. Over half of the student responded with the highest possible rating (4 on a scale ranging from -4 to neutral to +4) that an overall benefits package, and promotion opportunities are important factors in their job selection. The average scores (mean) were strong for these items, and the Standard Deviation (below 1) indicates very little variation between subjects in responses to these items. Above average salary is strongly preferred by almost half of the respondents although the standard deviation reflects stronger variance on this item (several students rated high salary with a 0=no impact). Lateral mobility is a positively perceived job attribute but is not nearly as attractive as benefits, upward mobility, and salary.

As a group there were no strong preferences regarding metropolitan versus rural work locations. In general, there was a slight preference for a metropolitan environment with the more plentiful social and cultural events. This metropolitan preference may reflect the importance of social-life factors to most new graduates. Thus, a firm that is targeting the hiring of many new graduates may have better prospects if offering work near a metropolitan area.

Table 2 illustrates descriptive statistics related to intrinsic characteristics of the work itself. Regarding the 'Type of Work' category students seem particularly interested in the opportunity to work with leading edge technologies and to perform a variety of different tasks. These work characteristics probably correspond to work that is 'fun' and 'self gratifying' which is the most significant factor influencing graduates job decisions. Nearly 60 percent of respondents marked the highest possible rating concerning work being self gratifying and fun. Todays graduates are likely to avoid jobs that are viewed as "all work, and no play".

Being involved in the total project (beginning to end) is also highly attractive to many students; however, the large standard deviation shows

TABLE 1

DESCRIPTIVE STATISTICS FOR JOB SECURITY, ADVANCEMENT, PAY & BENEFITS, AND LOCATION (N=132)

Category / Item	% Rating Factor as a Strong Positive Impact (4) in Job Decision	Mean	Standard Deviation
Job Security			
JC33 Job security is assured if you do your job	41.7	3.0379	1.0586
Advancement Opportunities			
JC48 Opportunities for lateral mobility (job rotation)	18.9	1.9621	1.6364
JC49 Opportunities for upward mobility (promotion)	53.0	3.2576	.9460
Salary and Benefits			
JC27 Job offers above average salary	47.0	3.1212	1.0340
JC28 Overall benefits package (insurance, pension, etc.)	54.5	3.3333	.8708
Location			
JC24 Geographical location is metropolitan (many cultural events)	14.4	1.4091	1.8073
JC25 Geographical location is rural (no 'big city' traffic & hassles)	4.6	.2901	2.0248

there is significant variation in how desirable 'cradle to grave' involvement is. This variation likely reflects the attitude of some students who prefer specialized skills and focused project sub-tasks. Respondents report only moderate concern about the business or social impact of projects they work on.

Respondents report some preference for job autonomy and decision discretion regarding work procedures. Nonetheless, there was also moderate attraction for an environment that adheres to well defined development processes. Thus, it appears these respondents are not adverse to working in environments where methodologies place some discipline and bounds on the approach to systems development.

The concept of "continuous learning" has strong advocacy among pending graduates. Respondents highly prefer work environments that will encourage and support their ongoing professional growth and learning. Items related to professional growth, learning, and updating were strongly preferred by most respondents. The high mean scores and low deviation on these items demonstrate that nearly all respondents reported a strong preference for these work environment attributes.

The items evaluating Work Load characteristics support the Gen-X preferences and desire for play and personal time. A large portion of graduates

TABLE 2

DESCRIPTIVE STATISTICS FOR TYPE OF WORK, DECISION LATITUDE, AND GROWTH OPPORTUNITIES (N=132).

Note: %Rating" column reports the percent Rating Factor as a Strong Positive Impact (4) in Job Decision;
* %Rating column reports the percent marking Strong Negative Impact (-4) if the mean rating was negative.

Category / Item	% Rating	Mean	Standard Deviation
Type of Work			
JC37 Frequent opportunities to be creative and innovative	36.6	2.8550	1.1240
JC26 Opportunities to work with leading edge technologies	43.9	3.0000	1.1459
JC38 Opportunities to work with emerging technologies	36.6	2.8855	1.0716
JC39 Opportunities to be involved with a project from beginning to end	28.8	2.9394	2.9024
JC40 Opportunities to perform a variety of different tasks	35.6	2.8788	1.1327
JC41 Opportunities to specialize skills for focused sub-tasks	9.8	1.8561	1.4310
JC44 Opportunities to work on challenging tasks where success is uncertain	8.4	1.4122	1.7136
JC45 Opportunities to work on known tasks for which you have skill mastery	15.9	1.8182	1.6337
JC46 Opportunites to work on projects with significant business impact	21.2	2.3485	1.3647
JC47 Opportunities to work on projects with significant social impact	18.2	1.8864	1.5014
JC52 Work will be self gratifying, a fun experience	59.8	3.3485	1.0188
Decision Latitude			
JC6 Firm adheres to well defined I/S development processes	15.9	2.0152	1.4302
JC8 Individuals have decision discretion regarding work procedures	26.5	2.3864	1.5115
JC21 Job autonomy permitted rather than close supervision	25.8	2.5606	1.2185
Growth/Learning Opportunities			
JC13 Firm encourages professional development & learning	51.1	3.3435	.8206
JC14 Firm facilitates professional updating (including tuition assistance)	50.8	3.2615	.9446
Work Load (encroachment on personal time)			
JC15 Firm requires you to work substantial overtime	**14.4***	**-1.0455**	**1.9880**
JC16 Boss expects you'll do 'whatever it takes' to meet project goals	4.5*	-.5455	1.9822
JC20 Firm requires you to wear a beeper (be on-call during non-work hours)	12.9*	-1.0076	1.8138
JC23 After working standard week (40 hours) I can control free time	33.3	2.5530	1.3942
JC50 Travel requirements are limited and well defined	19.7	1.7424	1.7193

TABLE 3

DESCRIPTIVE STATISTICS FOR SOCIAL ENVIRONMENT (N=132).

Note: %Rating" column reports the percent Rating Factor as a Strong Positive Impact (4) in Job Decision;

Category / Item		% Rating	Mean	Standard Deviation
Social Environment				
JC1	Firm encourages a friendly working environment	56.4	3.3459	.8532
JC4	Collegial atmosphere where team accomplishments are rewarded	26.7	2.5878	1.2580
JC5	Competitive atmosphere: individual accomplishments are rewarded	21.2	1.5833	2.1580
JC9	Firm encourages efficient electronic communication	26.7	2.2901	1.5367
JC10	Firm encourages personal face-to-face communication	23.5	2.2424	1.4469
JC22	Dress code is informal (business casual)	29.5	2.3864	1.5216
JC32	Job involves working with a broad variety of people	15.2	2.0530	1.4688
JC34	People know how/when to relax, have fun	37.9	2.7273	1.3313

reported strong negative reactions (25% marked either -4 or -3 on the survey scale) to substantial overtime. Similarly, a substantial portion of respondents were adverse to wearing a beeper and being on-call. One third of all respondents indicated a very strong preference for maintaining total control over their free time. This adds to the recruiting challenges for firms that are mean, lean, and working on year 2000 compliance or other time critical projects.

Table 3 reports descriptive statistics reflecting social characteristics of the work environment. Responses to the items about "friendly working environment" and "people know how/when to relax, have fun" reinforces the perspective that I/S graduates want to have fun and enjoy their work environment. The high mean score, low standard deviation, and large proportion of respondents rating this item with a maximum score suggest that a friendly work environment will have a substantial impact on recruitment (and retention) of these I/S graduates. As such, firms should consider the type of social atmosphere these recruits will experience during site visits. While there is only mild desire to work with a broad variety of people, a high mean score for 'collegial atmosphere' does support the preference for a friendly and collaborative workplace. Nonetheless, a large portion (21%) of respondents strongly prefer a competitive atmosphere where individual accomplishments are rewarded.

A recent corporate trend has been to relax the formality of the workplace by implementing casual dress policies. In regards to attracting I/S recruits this policy liberalization seems to be well focused. Nearly 60% of survey respondents had very strong (marked 3 or 4) preferences for casual dress in the work environment. It is unlikely that any I/S organization can afford to alienate this portion of potential job recruits given the scarcity of potential candidates.

Response to items referencing communications mechanisms suggest these graduates are very comfortable with electronic forms of communications but that personal face-to-face communication is also desired.

Table 4 illustrates descriptive statistics depicting items characterizing Organizational Reputation, Structure, and Management Style. Responses concerning company reputation and growth show that graduates are interested in organizations that have a clear direction and a reputation for innovation. The responding students have a tendency to be risk averse in that few prefer jobs in organizations that have promising but uncertain business prospects. Nonetheless, there was only moderate preference for large, established firms.

As a group these future I/S professionals had no preference relative to organizational structure. Approximately forty percent of student respondents indicated working in an I/S business unit versus a non-I/S business unit would have 'no impact' (response = 0 on rating scale) on their job decision. Although respondents slightly favor an I/S business unit, very few students reported a strong preference concerning the type of organizational unit they would work in. This is good news for firms that are moving toward cross-functional work teams. Furthermore, respondents generally demonstrate a preference to work with other professionals in a team environment.

Again demonstrating a dislike for uncertainty, subjects reported relatively strong preferences for clear goals, well defined expectations and work structures. Furthermore, respondents prefer work environments where they have some input regarding project assignments and they desire management to provide timely feedback regarding work performance. While the sample reported a preference for a relaxed, fun environment they also indicate a moderate preference to work in a professional atmosphere where people are serious about getting work done and quality standards are enforced.

DISCUSSION/CONCLUSIONS

In summary, survey results show graduating I/S students most prefer a work environment that involves fun, self-gratifying work in a friendly working environment where people know how and when to have fun. Today's graduates are unlikely to work for an organization that promotes all work and no play (King, 1997b). While having some affinity for a professional atmosphere, enforcing quality and getting work done, these job recruits are adverse to environments that will infringe on their personal time. They do not want to work substantial overtime and they do not want to be on-call.

Related to the concept of self-gratifying work, these job candidates are very interested in jobs that provide growth, learning, and professional development opportunities. They are strongly attracted by work that includes opportunities to work with leading edge, emergent technologies, opportunities to be innovative, and to perform a variety of differing tasks.

Next in order of preference is the extrinsic factors of a job. Respondents are strongly interested in their total benefits package, salary, opportunities for promotion, and job security. While the

TABLE 4

DESCRIPTIVE STATISTICS FOR ORGANIZATIONAL REPUTATION, STRUCTURE, AND MANAGEMENT STYLE (N=132).

Note: %Rating" column reports the percent Rating Factor as a Strong Positive Impact (4) in Job Decision;

Category / Item	% Rating	Mean	Standard Deviation
Company Reputation & Growth			
JC2 Business directions/plans of the firm are well defined	39.1	2.8571	1.2379
JC3 Business prospects of the firm are promising but uncertain	3.8	.5115	2.0052
JC11 Firm is large and has a significant history of growth & stability	22.1	1.8931	1.6745
JC12 Firm has a reputation for innovation	27.7	2.5923	1.2801
Organizational Structure			
JC30 I/S professionals work in a distinct I/S business unit	3.8	.9237	1.5621
JC31 I/S persons work in functional area (non-I/S) business unit	1.5	.5802	1.4568
JC43 Opportunities to work closely with other I/S professionals (work in team)	17.4	2.2197	1.3942
Management Style			
JC51 Work structure and expectations are well defined	26.0	2.5115	1.4053
JC7 Firm (management) provides clear goals	34.1	2.9015	1.1042
JC29 Being able to influence which projects you work on	27.5	2.6947	1.1293
JC35 Professional atmosphere: serious about getting work done	24.2	2.1970	1.6084
JC36 Quality guidelines enforced . . . Firm ensures all work meets standards	23.7	2.2901	1.4438
JC42 Opportunities to receive timely feedback regarding work performance and quality	31.1	2.6742	1.2691

importance of compensation and other extrinsic rewards cannot be questioned, these respondents attached more importance to intrinsic factors (interesting, fun, innovative, learning work environments) than they did to extrinsic rewards.

Another factor that was generally rated highly important relates to organization and management aspects. In general, respondents demonstrated low ratings on items that depicted environments involving uncertainty or ambiguity. Respondents showed a distinct preference to work for firms where the business direction and future plans of the firm were well defined. They also prefer working in environments where management provides clear goals but then allows the worker latitude in deciding how to implement solutions.

A recent Computerworld article regarding job factors of importance to current I/S Professionals provided the importance rankings illustrated in Table 5. While the items asked in the two surveys differ it is still possible to make some comparisons. The quality of boss issue raised by I/S employees may well correspond to creating the fun, friendly working environment sought by students. Similar to I/S employees the students expressed interest in the technology direction of the organization, and the opportunity to use new technologies. Unlike the veteran I/S workers, students attached a much higher importance to having training and educational opportunities so they can keep up with technology changes. Perhaps graduating students are more interested in exerting the effort needed to prepare for tomorrow's technologies. Industry press suggest that existing I/S staffs are unprepared to work with new technologies; research is needed to determine how much personal effort veteran I/S workers are willing to exert in order to keep up-to-date.

Organizations apparently face a major challenge in regards to supporting legacy systems that are implemented using traditional technologies. Both veteran staff and I/S students report a strong preference to work with new technologies. The U.S. pipeline of programming talent is focusing on work using technologies that they consider to be fun and sexy (Goff, 1997). Thus, firms may have difficulty locating persons who are willing to work with older technologies. Ultimately, firms may need to look off-shore to find new programmers who are trained and motivated to use more humble technologies (Yourdon, 1997).

TABLE 5

RANKED IMPORTANCE OF JOB ATTRIBUTES (FROM SCHEIER 1997)

Responses based on rankings by 200 I/S employees who had recently considered changing jobs.

Quality of the boss
Technology Direction of the I/S Department
Ability to use new technology
Job Security
Financial Stability of the Organization
More Challenging Assignments
Location
Base Salary
Faith in future business direction of the Firm
Training Opportunities
Retirement Plan
Bonus Plan

Whereas students were more interested in a well defined direction for the firm and promotional opportunities, veteran I/S employees seem to be more interested in the financial stability of the organization and job security. These veterans (who were considering job change) were more interested in job security than in salary and bonus plans. In contrast, students were more interested in overall benefits and salary than they were in job security (although security was still important). Another interesting difference is that veterans are more interested in work location than in salary and bonuses. In contrast, students were relatively moderate in their preferences for job location and rated compensation factors significantly higher than work location factors. Based on these results it appears graduating I/S students are likely to be more flexible than veteran I/S workers relative to work location and potential relocation. Conversely, new I/S graduates may be more strongly influenced by attractive compensation packages.

Overall, the job preferences reported by students aligns well with the job preference and motivating factors reported in previous research. Weaver (1976) and others found that meaningful work was the most preferred job attribute, especially among professional and technical workers. Couger and Zawacki (1980) found that work itself was a strong motivator for I/S workers. In addition, I/S workers were found to have a high "growth need strength". Similarly, students expressed a strong desire for professional growth opportunities. Nonetheless, students also expressed an extremely strong preference for fun, friendly, collegial work environments; this somewhat conflicts with the low "social need strength" reported by Couger and colleagues.

ENDNOTE

1. King (1997d) reports a 43% decline in U. S. computer science graduates between 1986 and 1994. This decline is partially offset by increasing graduation rates in some foreign countries.

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THE INFORMATION SYSTEMS INDUSTRY: WHAT ABILITIES DOES IT WANT FROM ITS NEW HIRES? A LOOK AT THE SOUTHEASTERN U.S.

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In order to identify the IS backgrounds and skills most in demand among employers in the Southeastern US, the classified ads appearing in the region's major cities during the summer of 1997 were content analyzed. This paper reports the major findings of this investigation and heir curriculum implications. It also outlines potential follow-up investigations for this and other newspaper want ad content analysis studies.

INTRODUCTION

Conscientious faculty in colleges/schools/ departments of business administration are always attempting to remain current in their fields. In addition, they want the students enrolled in their degree programs to be prepared to succeed in careers within their chosen disciplines. To be prepared, the students must be offered a curriculum that is broad, meets accreditation standards, is current, and provides courses and internship experiences which give them the background required by employers and graduate programs. The pace of change in this highly dynamic disciples such as information systems presents faculty with the ongoing challenge of maintaining a curriculum that meets these criteria.

The primary purposes of this investigation were to determine the educational/practical background(s) that Southeastern US employers of undergraduate alumni of Information Systems program are requesting and to gather both timely and relevant information to assist in the revision of an Information Systems Curriculum. The motivation for the study was two-fold: (1) the desire to offer (maintain) a curriculum which satisfies the criteria stated earlier and (2) the need/opportunity to convert an existing quarter-based curriculum to a semester basis.

The authors decided to adopt an approach employed in earlier works that scanned the classified advertisements for entry level information systems positions. For example, Jacobson and Armstrong (1996)—the winners of the Best Paper Award at the 1996 IAIM Conference—used this approach in their analysis of the job market in the Middle Atlantic States. Several similar efforts aimed at gleaning high-demand IS skills by content analyzing newspaper ads include Athey and Plotnicki (1992), Arnett and Litecky (1994), Prabhakar, Litecky, and

Arnett (1995), Todd, McKeen, and Gallupe (1995), and McLean and Schneberger (1997). In this investigation, a methodology similar to that employed by Jacobson and Armstrong (1996) was applied to states in the southeastern United States.

METHODOLOGY

The current investigation focuses on the educational/practical background(s) that potential employers of undergraduate alumni of Information Systems degree programs are listing as requirements for new hires in their classified ads in southeastern U.S. newspapers in the following southeastern states: Alabama, Florida, Georgia, North Carolina, and South Carolina.
This investigation is the first in a planned sequence of multiple empirical studies aimed at identifying trends in the demand for both "hard and soft" IS skills among employers in the Southeastern US. A future investigation will attempt to replicate the findings of this investigation through the content analysis of on-line want ads (both for newspapers and independent listing services). Other investigations will involve comparing the IS skill trends observed by IS "headhunter" firms and alumni of an IS program to those obtained in this investigation, and contacting employers placing want ads in print and on-line media to determine the extent to which new hires actually satisfy the requirements stated in their ads.

In order to develop a grid of skills/competencies for use in the actual data collection phase of this investigation, classified advertisements for IS jobs listed in the Sunday editions of the *Savannah Morning News* and the *Charlotte Observer* during the Spring of 1997 were collected. The IS skills and backgrounds listed in these ads were used to develop a "first cut" classification scheme for ads appearing in future editions of these and other newspapers The first cut version of the grid was subsequently refined and expanded after testing its applicability to a Sunday edition of the *Atlanta Constitution* during May of 1997. The resulting grid, implemented as a Lotus Excel spreadsheet, was used to analyze the content of want ads for IS positions appearing in the Sunday editions of the major newspapers published in Atlanta, GA, Birmingham, AL, Charlotte, NC, Columbia, SC, Jacksonville, FL, and Tampa, FL. It consisted of nearly two-hundred distinct criteria grouped into numerous categories including general job skills, IS skills, IS certifications, educational backgrounds, programming languages, operating systems, hardware platforms, networking technologies, application packages, database technologies and development tools.

The coding heuristics and procedures used to tally the IS skills mentioned in the newspaper want ads generally replicated the procedures employed by Jacobson and Armstrong (1996). That is,

> ...the study was limited to ads for business-oriented IS positions placed by organizations for their own work force and to ads placed by consulting firms who hire individuals to work for them. If the advertisement was for a specific number of positions with a particular set of skills, the need for those skills was tallied for that number. However, when the number of positions to be filled was not indicated, the skill was tallied only once (p. 45).

The classification procedures that were utilized enabled the researchers to compare the demand for IS positions across both cities and dates. It also enabled us to identify some general patterns in the demand for specific IS skills that is capable of providing guidance in IS curriculum revision decisions. Some of our major findings are reported in the following section.

RESULTS

As may be observed in Table 1, a total of 727 IS want ads appeared in the major newspapers from the target Southeastern US cities on the first Sunday in June, July, and August, 1997. These were content analyzed using the refined version of the previously mentioned skills grid that had been developed.

Consistent with its size and its reputation of being one of the key IT/IS centers in the southeastern US, more job listings appeared in the *Atlanta Constitution* than in any of the other newspapers. As Table 1 shows, the second highest number of IS want ads appeared in the *Charlotte Observer*, and nearly one hundred ads were found in the Birmingham, AL and Tampa, FL newspapers. Table 1 also indicates that more IS

TABLE 1

NUMBER OF ADS FOR EACH PAPER BY MONTH

	Atlanta	Birmingham	Charlotte	Jacksonville	Miami	Columbia	Tampa	TOTALS
June 1, 1997	63	31	38	25	25	18	39	239
July 6, 1997	51	25	26	25	19	16	19	181
August 3, 1997	90	43	51	26	31	27	39	307
TOTALS	**204**	**99**	**115**	**76**	**75**	**61**	**97**	**727**

want ads were published on the first Sunday of August, 1997 than for the first Sundays in either June or July 1997.

As may be observed in Table 2, the most frequently mentioned general job skills mentioned in the want ads of the major newspapers in the Southeastern U.S. during the summer of 1997 include project management and coordination, interpersonal/communication skills, problem solving and analytic skills, and general job skills. Written, oral, and presentation skills were each mentioned in less than five percent of the IS wants ads examined in this study.

TABLE 2

PERCENTAGE OF ADS

	June	July	August	TOTALS
Coordination/Project Management	16.18	15.69	22.06	15.13
Interpersonal Skills	9.80	12.25	24.02	12.93
Problem Solving & Analytical	9.31	8.33	13.73	8.80
General job skills	6.37	7.35	15.20	8.12

INCLUDING GENERAL JOB SKILLS

As Table 3 indicates, the most commonly listed IS skills address the entire systems development life cycle including design/development skills, hardware/software implementation skills, and operation and management skills. Other information skills including Year 2000 compliance skills/experience, and database administration skills were mentioned in only a very small percentage of the IS want ads that we examined.

TABLE 3

PERCENTAGE OF ADS INCLUDING INFORMATION SYSTEMS SKILLS

	June	July	August	TOTALS
Design/Development	19.61	15.20	26.96	17.33
Hardware/Software Implementation	7.84	13.73	19.12	11.42
Operation & Maintenance	6.37	13.24	13.24	9.22

Table 4 illustrates that a bachelor's degree was the most common education requirement listed in the newspaper ads for IS positions. Associates degrees, masters degrees, and doctoral degrees were rarely mentioned in the ads included in this sample. Professional certifications such as Novell's CNE and Microsoft's MSCE were rarely mentioned in the IS want ads that we collected and analyzed. Table 5 shows that one to five years of work experience were most commonly listed.

TABLE 4

DIPLOMA/DEGREE

	June	July	August	TOTALS
Bachelors Degree	30.39	23.53	47.06	28.34

TABLE 5

YEARS EXPERIENCE

	June	July	August	TOTALS
3-5 years	25.49	21.57	40.69	24.62
1-2 years	34.80	16.67	32.84	23.66

As is indicated in Table 6, specific hardware platforms were mentioned in many of the job listings. However, jobs focusing on microcomputer and client/server computing platforms were mentioned in more ads than jobs involving midrange and mainframe systems.

TABLE 6

HARDWARE PLATFORMS

	June	July	August	TOTALS
PC's	18.63	25.00	31.86	21.18
Client/Server	20.59	23.04	40.20	28.06
Midrange Systems	15.20	14.71	32.35	17.47
Mainframe Systems	11.27	10.29	13.73	9.90

Windows NT was the most frequently mentioned network operating system in the job ads, but UNIX, and Win95 or Windows 3.x were also mentioned quite frequently (see Table 7). Table 7 also illustrates that OS/400 was the most commonly mentioned operating system for midrange systems and that Novell NetWare was also mentioned in numerous ads.

TABLE 7

PERCENTAGE OF ADS MENTIONING (NETWORK) OPERATING SYSTEMS

	June	July	August	TOTALS
Windows NT	36.76	23.04	40.20	28.06
UNIX	31.37	21.08	32.84	23.93
Windows 3.x or 95	22.06	17.16	34.80	20.77
OS/400	20.10	12.75	26.96	16.78
Novell NetWare x.x	8.82	11.76	24.51	12.65

The most commonly listed programming languages found in our content analysis of newspaper ads for IS positions are summarized in Table 8. COBOL was the most common programming language mentioned in the ads. It is possible that this reflects the growing pre-occupation with the Year 2000 problem; it may also reflect the existence of numerous legacy applications coded in COBOL in cities in the southeastern US. After COBOL, Visual Basic and C++ were the two most common programming language skills mentioned in the job ads. C and RPG were mentioned in numerous ads and Java and HTML were the most commonly mentioned languages for Internet and WWW applications.

Table 9 summarizes the most frequently mentioned application packages. As this table shows, IBM's Customer Information Control System (CICS) is still a marketable skill in major cities in the Southeastern U.S. Lotus Notes was the most frequently mentioned groupware product and Word and Excel were the two most commonly listed end-user applications mentioned in the job listings. As shown in Table 10, Powerbuilder was the most commonly mentioned client/server application development tool; no other application development tool of any type was specifically mentioned two percent or more of the ads in our sample.

TABLE 8

PERCENT OF ADS MENTIONING SPECIFIC PROGRAMMING LANGUAGES

	June	July	August	TOTALS
COBOL	49.02	25.00	53.43	35.76
Visual Basic/VB	31.37	20.10	38.73	25.31
C++	35.78	19.12	34.80	25.17
C	27.94	13.73	18.14	16.78
RPG	16.67	10.29	20.10	13.20
JAVA	13.24	7.84	5.88	7.57
HTML	9.31	6.86	5.88	6.19

TABLE 9

PERCENTAGE OF ADS INCLUDING SPECIFIC APPLICATION SOFTWARE

	June	July	August	TOTALS
CICS	25.98	12.25	22.55	17.06
Lotus Notes	16.18	6.37	8.33	8.67
Word (Microsoft)	8.82	6.86	11.76	7.70
Excel (Microsoft)	8.33	7.84	10.29	7.43

TABLE 10

PERCENTAGE OF ADS MENTIONING SPECIFIC DEVELOPMENT TOOLS

	June	July	August	TOTALS
PowerBuilder	17.16	11.27	15.69	12.38

Table 11 shows that Oracle was the most commonly mentioned database application mentioned in want ads that we examined and that SQL was the most commonly mentioned database application language. DB2 appears to be the second most common database system in the Southeastern U.S. and our results suggest that Access is the most common microcomputer-oriented database system.

TABLE 11

PERCENTAGES OF ADS REFERRING TO SPECIFIC DATABASE SYSTEMS

	June	July	August	TOTALS
Oracle	26.96	15.69	26.47	19.39
SQL	25.49	14.22	23.53	17.74
DB2	21.57	11.27	16.18	13.76
Access (Microsoft)	17.65	12.25	18.63	13.62
Sybase	9.31	7.35	10.78	7.70
FoxPro	7.84	4.41	10.78	6.46
IMS	10.29	3.43	7.35	5.91

DISCUSSION

When our results are compared to those obtained by Jacobson and Armstrong (1996) concerning the entry-level job market in the Middle Atlantic States, both similarities and points of departure can be noticed. Our findings for the types of general job skills and IS skills mentioned in the IS want ads are largely consistent with Jacobson and Armstrong's 1996 data. However, IS skills tended to be mentioned more frequently in Jacobson and Armstrong's Middle Atlantic cities.

The percentage of ads mentioning operating systems and network operating in our sample tended to be higher than that reported by Jacobson and Armstrong. The demand for IS professionals with Windows NT experience is notably higher in our sample (by a factor of 3) and both OS/400 and NetWare were also mentioned more frequently in our sample of IS want ads. UNIX was identified slightly less often in our sample of ads.

Our findings for database systems is largely consistent with those obtained by Jacobson and Armstrong with Oracle being the clear leader in both regions of the country. However, in the southeastern US in the Summer of 1997, both DB2 and Access were mentioned more often, while Sybase was mentioned less often.

Like those for Jacobson and Armstrong, our findings indicate that Powerbuilder is the most frequently mentioned client/server application development tool. For application software, relative to Jacobson and Armstrong, the frequent mention of CICS experience is notable in our sample while SAP was mentioned less often in our sample of newspaper ads. Most of the rest of our findings for application software and development tools are consistent with those reported by Jacobson and Armstrong.

Comparing our results for Atlanta to McLean and Schneberger's (1997) analysis of 10,000 Georgia IS want ads indicates more similarities than differences. Like these researchers, our findings indicate that UNIX, C, C++, Visual C++, COBOL, DB2, Powerbuilder and AS/400 programming skills are in high demand in the Atlanta/Georgia IS job market as is Oracle, SQL, and Visual Basic. Our results for general job skills and IS skills is also largely consistent with those reported by McLean and Schneberger. Unlike McLean and Schneberger, business skills (such as finance, operations, accounting, and sales) were more likely to be mentioned in our sample of ads.

Curriculum Implications

There are several notable curriculum implications of our findings. First, the results suggest that it is important for IS curricula to emphasize both "hard" and "soft" IS skills. While specific technical competencies may help the graduates of IS programs obtain jobs, our results strongly suggest that communication, interpersonal, and teamwork-oriented skills (such as project management/coordination) are valued by employers.

The results also suggest that it is important for IS program graduates to be well-grounded in systems development processes and that the traditional systems development life cycle continues to serve as useful framework for helping students understand the tradeoffs associated with different platforms, applications, programming languages, and data access alternatives. Skills mentioned in the ads in our sample run the full range of the systems development life cycle.

Another important implication of the broad range of technical skills mentioned in the newspaper job listing that we analyzed is it is important for students graduating from IS programs to be prepared to develop new technical skills and competencies on an ongoing basis. IS is a highly dynamic field and lifelong learning is essential for career success and professional growth and development. As such, it is important for IS faculty to instill a love of learning in their students as well as to provide the conceptual foundation on which such learning can occur.

Future Research

In order to assess the generalizability of our findings, several follow-up investigations are planned. First, now that a workable skills grid and content analysis approach has been developed, the authors intend to leverage the work invested in this study by attempting to replicate it on an annual basis. This will enable us to perform longitudinal assessments and to identify shifts in the demand for specific skills and competencies among employers of IS program graduates in the southeastern US.

To assess the generalizability of our findings beyond newspaper ads, another follow-up study is planned that will involve the application of our final skills/competencies grid to WWW IS job listings for cities in the southeastern U.S. Numerous newspapers have on-line classified ads (including want ads). In addition, independent Web-based IS job listing services have been developed for several major cities. It should be noted that the job listings available through such services are distinct from on-line classified ads posted on the Web by newspapers. While the same job may be listed in both venues, there may be differences in both content and format. Assessing/identifying these distinctions and determining the degree to which the IS skill patterns in these forums mimic those in print media (newspaper want ads) should provide another appropriate test of the generalizability of the findings of this investigation.

The investigators also plan to utilize the results of this newspaper classified ad study to develop survey instruments for administration to at least three distinct samples: job placement ("headhunter") firms, employers of the graduates of our IS program, and alumni of our IS program. The pattern of results that we obtain from survey respondents along with the findings of our analyzes of newspaper ads and on-line job listings should, in combination, provide solid evidence of the types of IS skills/competencies that are in high demand among employers in the Southeastern U.S. Such information should enable IS program faculty in our region of the United States to develop curricula that balance student acquisition of high-demand skills/competencies with an educational foundation that is conducive to lifelong learning.

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APPLYING WHAT CIS FACULTY TEACH TO SUPPORT ACCREDITATION EFFORTS--A CASE STUDY

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INTRODUCTION

The management challenge for colleges of business is changing. Expectations from the many constituents, e.g., students, employers, legislatures, and the public have increased dramatically. Delivery systems are changing in response to cost pressures and to take advantage of developing technologies. Competition is increasing from profit making organizations and public institutions who are using technology to extend their reach. Management education at the university level is becoming more of an open system in which former boundaries are fading as a barrier to competition.

Accrediting organizations have responded to these new demands by moving to mission-based, process oriented, assessment-driven standards for accreditation. This movement parallels but lags developments in industry. In colleges of business, this mission-driven focus with its emphasis on process improvement requires significant adaptations for faculty and creates new demands for information to support administrative processes. The new information demands give information systems faculty an opportunity to put what they teach into practice.

The changing times demand that colleges of business direct increasing attention to new competitive forces. Industry competition, the seeming universal presence of private schools such as the University of Phoenix in many markets, and the possibility that nearly any institution can deliver courses anywhere via the World Wide Web (WWW) all necessitate greater attention to:

- Allocating limited resources to clearly focused activities
- Considering results from the perspective of multiple constituents
- The effectiveness of processes
- The need to continually improve

Colleges of business have little choice but to improve their management. To monitor processes and outputs and manage more effectively, relevant information is needed on a timely basis. Traditional central university systems often may not respond fast enough nor have the relevant information. The situation is ripe for the application of the knowledge and expertise taught in colleges of business.

This paper describes the efforts at an AACSB accredited college of business as it responded to the new mission-driven management expectations and prepared for the formal review of its accreditation status by the AACSB. Under the direction of Computer Information Systems (CIS) faculty, end-user systems were developed to manage initial management efforts, track compliance with accreditation standards, track course scheduling, provide historical data to inform processes for setting faculty qualifications and intellectual contribution goals, and plan faculty requirements. The system used PC-based database and spreadsheet software packages.

In this paper the organizational processes needing to be addressed are identified. Opportunities for improved information system support of the processes are described, accomplishments noted, and future intentions outlined. Finally, lessons learned are shared.

WHAT WE SOUGHT TO DO

An upcoming accreditation review and its associated information needs was the catalyst which triggered the internal college of business development efforts described in this paper. The reaccreditation effort included a major mission revision, establishment of faculty qualification criteria, assessment of compliance with faculty composition standards, development of processes for planning, faculty development, improvement of instruction, stimulation of intellectual activities, and enhancement of the curriculum.

Key process areas and information system support opportunities are shown in Table 1.

To meet these information needs, and in light of a lack of institutionally provided data, the CIS faculty established a PC-based system to support the accreditation efforts. Driven by initial needs for problem management and reports on compliance with faculty composition standards, early efforts focused on database design and development. Subsequent efforts used the database to assist in the development of a spreadsheet-based faculty planning system.

WHAT WE DID

We initially looked at a system that was commercially available and had been built using dBase. After reviewing the database structure and the limitations due to older technology, we decided to build our own system using Microsoft Access. An Access database system provided us with more flexibility, more power, access by multiple users, ease of use, ease of integration with other tools, and the ability to upgrade to new versions. The system was originally built using Access 2.0, was later upgraded to Access 7.0, and was recently converted to Office 97.

TABLE 1

KEY PROCESSES AND INFORMATION SYSTEM SUPPORT

College of Business Process	Support Opportunities for Internally Developed Information Systems
Guide reaccreditation process	· Problem tracking and reporting
	· Compliance with standards for faculty composition, qualification, etc.
Planning	· Accomplishment tracking, e.g., intellectual contributions, faculty development activities, etc.
	· Assembling data for assessing faculty qualification criteria
	· Tracking historical course, faculty, program data
	· Projecting qualification status changes for assessment of future standards compliance, faculty development planning, and staffing requirements
Develop faculty	· Projecting qualification status changes for faculty development planning
Enhance curriculum	· Providing course and faculty student credit hour data · Providing historical data on course offerings, including frequency and enrollments
Improve instruction	· Providing faculty teaching loads, number of course preparations, and student credit hours over time
Stimulate intellectual contributions	· Providing individual and aggregate historical results to inform process for setting aggregate goals and objectives
Develop faculty	· Providing individual and aggregate

qualification criteria	historical results · Examining the impact of faculty qualification criteria under consideration · Maintaining faculty qualification status
Administer the college	· Reporting on course, faculty, facility usage and trends · Assessing historical and current compliance with accreditation standards · Planning faculty staffing or development needs to remain within standards
Market the college	· Assembling information to meet needs of various constituencies

The system was built in an iterative fashion by first assembling the components of instructional data (course, semester offerings, numbers of students), faculty data, and faculty output (service, intellectual activity, and professional activity). Existing annual faculty reporting was used to drive the initial design of the data and entity-relationship structures in the database. Access forms were designed to aid the administrative staff in populating the database. Historical data for four years and current semester data was entered in the database from annual faculty reports, from faculty vitas, and from course data that was downloaded from the university's mainframe system.

An overview of the database structure and reporting is shown below.

Database Structure. The database system is built around a structure of about 30 main entities (tables) and 15 work entities that support data collection and reporting for the following general areas. An entity relationship diagram for the database is shown on the following page.

Faculty Information

- Faculty
- Office Hours
- Evaluation
- Reassign Time
- Qualified
- Status
- Discipline

Instructional and Student-Related Information

- Course
- Section
- Faculty Section
- Room
- Other Instruction
- Responsibility to Students

Intellectual Contribution Information

- Books
- Chapters
- Journal
- Journal Publication
- Meeting Output
- Other Publication

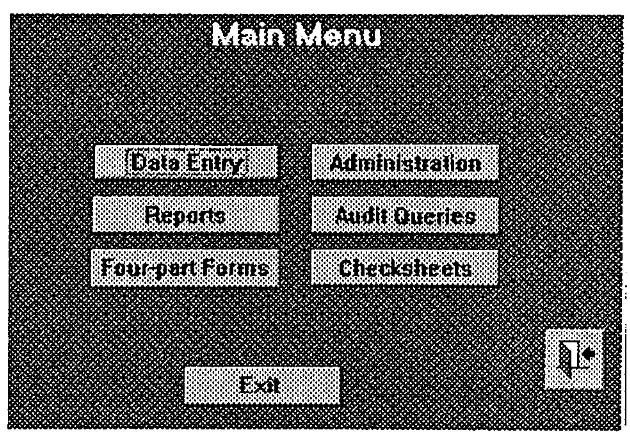
Professional Development Information

- Development
- Professional Association
- Professional Association Activity
- Professional Activity Organization
- Professional Activity

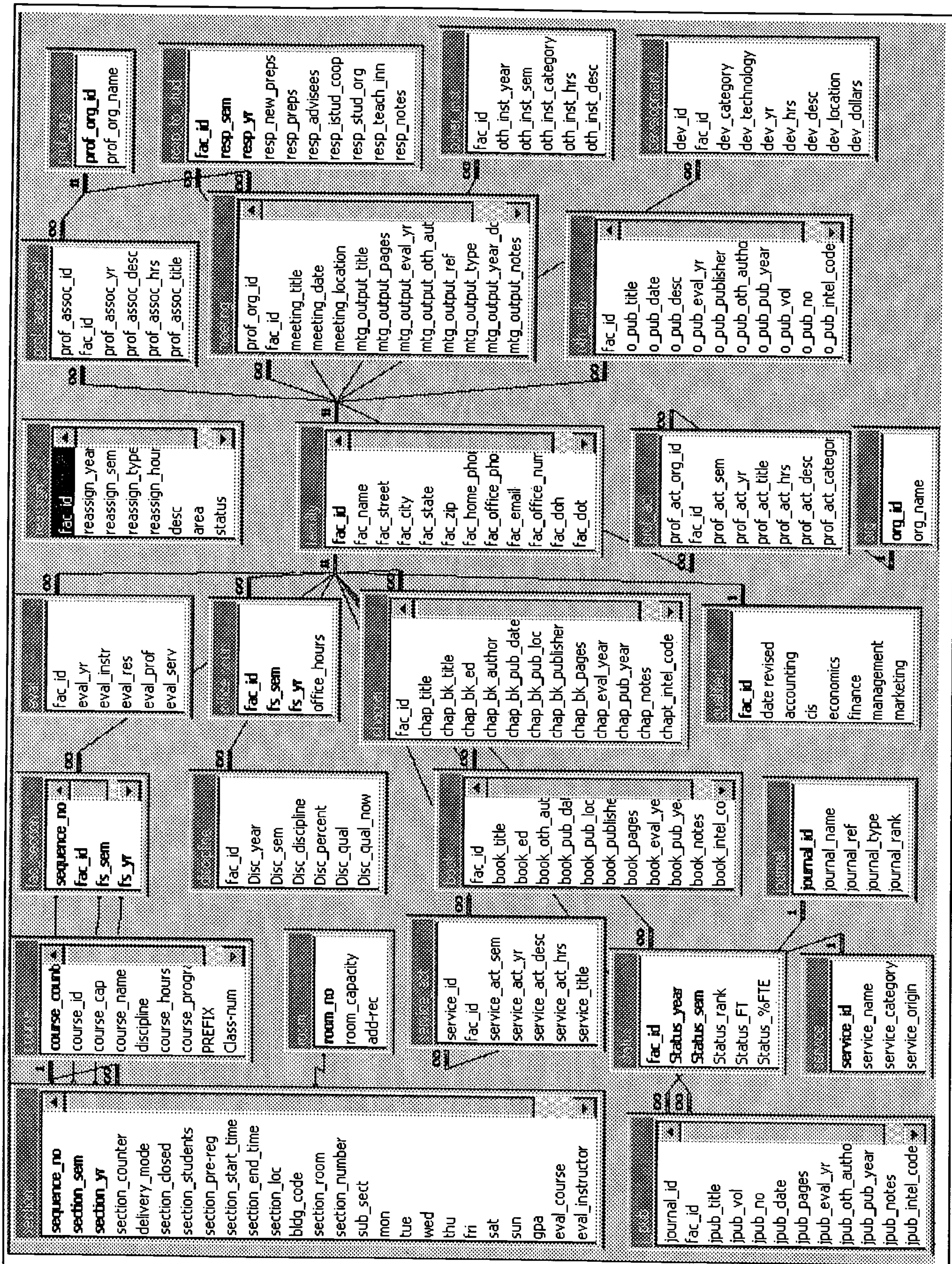
Service Information

- Service
- Service Activity

Data Entry. There are about 60 forms and subforms used to facilitate the data entry process. Most of the data entry using the forms is done by personnel in the dean's office. Class data that is maintained on the university mainframe is

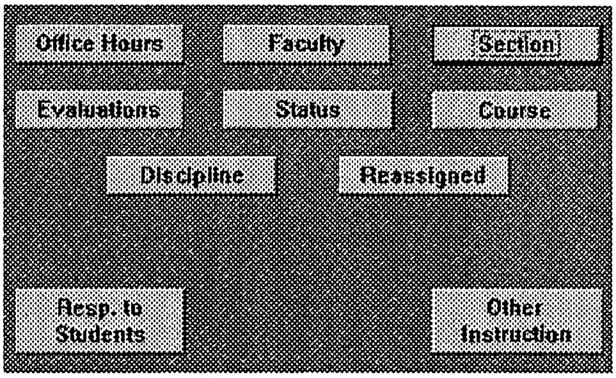


downloaded. The following window titled Main Menu is used by the office personnel to help them get to the various forms and reports.



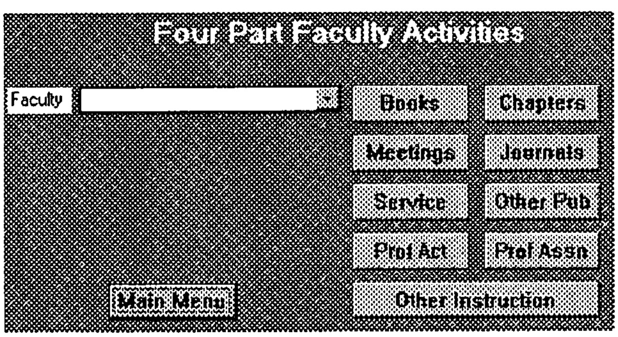
prof_org_id
prof_org_name
fac_id
resp_sem
resp_yr
resp_new_preps
resp_preps
resp_advisees
resp_istud_coop
resp_stud_org
resp_teach_inn
resp_notes
fac_id
oth_inst_year
oth_inst_sem
oth_inst_category
oth_inst_hrs
oth_inst_desc
dev_id
fac_id
dev_category
dev_technology
dev_yr
dev_hrs
dev_desc
dev_location
dev_dollars
prof_assoc_id
fac_id
prof_assoc_yr
prof_assoc_desc
prof_assoc_hrs
prof_assoc_title
prof_org_id
fac_id
meeting_title
meeting_date
meeting_location
mtg_output_title
mtg_output_pages
mtg_output_eval_yr
mtg_output_oth_aut
mtg_output_ref
mtg_output_type
mtg_output_year_dc
mtg_output_notes
fac_id
o_pub_title
o_pub_date
o_pub_desc
o_pub_eval_yr
o_pub_publisher
o_pub_oth_autho
o_pub_pub_year
o_pub_vol
o_pub_no
o_pub_intel_code
fac_id
reassign_year
reassign_sem
reassign_type
reassign_hour
desc
area
status
fac_id
fac_name
fac_street
fac_city
fac_state
fac_zip
fac_home_phoi
fac_office_pho
fac_email
fac_office_nur
fac_doh
fac_dot
prof_act_org_id
fac_id
prof_act_sem
prof_act_yr
prof_act_title
prof_act_hrs
prof_act_desc
prof_act_categor
org_id
org_name
fac_id
eval_yr
eval_instr
eval_res
eval_prof
eval_serv
fac_id
fs_sem
fs_yr
office_hours
fac_id
chap_title
chap_bk_title
chap_bk_ed
chap_bk_author
chap_bk_pub_date
chap_bk_pub_loc
chap_bk_publisher
chap_bk_pages
chap_eval_year
chap_pub_year
chap_notes
chapt_intel_code
fac_id
date revised
accounting
cis
economics
finance
management
marketing
sequence_no
fac_id
fs_sem
fs_yr
fac_id
Disc_year
Disc_sem
Disc_discipline
Disc_percent
Disc_qual
Disc_qual_now
fac_id
book_title
book_ed
book_oth_aut
book_pub_dal
book_pub_loc
book_publishe
book_pages
book_eval_ye
book_pub_ye
book_notes
book_intel_co
journal_id
journal_name
journal_ref
journal_type
journal_rank
course_count
course_id
course_cap
course_name
discipline
course_hours
course_progr
PREFIX
Class-num
room_no
room_capacity
add-rec
service_id
fac_id
service_act_sem
service_act_yr
service_act_desc
service_act_hrs
service_title
fac_id
Status_year
Status_sem
Status_rank
Status_FT
Status_%FTE
service_id
service_name
service_category
service_origin
sequence_no
section_sem
section_yr
section_counter
delivery_mode
section_closed
section_students
section_pre-reg
section_start_time
section_end_time
section_loc
bldg_code
section_room
section_number
sub_sect
mon
tue
wed
thu
fri
sat
sun
gpa
eval_course
eval_instructor
journal_id
fac_id
jpub_title
jpub_vol
jpub_no
jpub_date
jpub_pages
jpub_eval_yr
jpub_oth_autho
jpub_pub_year
jpub_notes
jpub_intel_code

The Data Entry button on the Main Menu window brings up another menu window shown on the following page. This window allows the user to select the forms that perform data maintenance on various tables. This includes data on faculty, office hours, course data, sections offered, discipline of the faculty, reassigned time (administration, research, and curriculum development) other responsibilities to students



(advisement load, job placement, organization advisors), and other instruction (internships, independent studies, thesis committees).

Faculty activity other than teaching is entered by selecting the Four-part Forms button on the Main Menu. This brings up the Four Part Faculty Activities window that follows. This window allows the user to select a specific name from the



faculty table and a form to enter data for that faculty member on various activities over any period of time.

These forms are used to enter most of the non-teaching faculty activity for each calendar year. Books, chapters, journals, meeting output (proceedings, papers), and other publications (working papers, regional reports) are all part of intellectual activity that is entered with slightly different formats. Service documents the activity related to college and university committees. Professional activity captures activity related to seminars and professional meetings, as well as other activity involved in learning new methods or new technology. Professional associations are used to record faculty activity relative to offices held and work done that is associated with professional organizations. Other instruction is another link to entering other types of instruction such as independent studies.

Reporting. The reporting system is supported by about 200 SQL queries, 50 different report definitions and a number of spreadsheet designs. Selected report titles are shown in the following list for each general reporting area. With the database, it was possible to prepare summary reports, such as those required for the AACSB self-study report, and to provide detail backup reports to support validation of the reports.

Administrative Support

- Reports for the AACSB self-study report
- Course Scheduling by Department, Room, Instructor and Time
- Office hour maintenance and reporting
- Teaching Assignments by Faculty, Area and Semester
- Projected compliance with AACSB standards by academic area

Instructional Output

- Student credit hours by programs, courses, and discipline
- Other instructional activity by faculty and semester
- Percentage Coverage of Student Credit Hours by Academically or Professionally Qualified Faculty
- Percentage Coverage of Student Credit Hours by Full-time Faculty by Discipline

Faculty Qualifications

- Faculty Size Composition and Qualification
- Faculty Qualification and Recent Publications

Intellectual Activity

- Books, Proceedings, Presentations, Abstracts, Journals and other publications by faculty and year

Service Activity

- Service activity by faculty, year and type of activity

Professional Development

- Professional development activity by faculty, year and type of professional development
- Professional activity by professional organization

VALUE OBTAINED

Perhaps, one of the best ways to demonstrate the value obtained from the system is through samples of the reports the system provides on one of the more complex aspects, that is, compliance with AACSB standards for faculty composition. Some of the summary level key reports for the self-study report are described next.

AACSB standards exist for the minimum number of full-time equivalent faculty required, the minimum number of academically qualified faculty, the minimum number of academically or professionally qualified faculty, and the maximum number of academically qualified faculty with no doctorate. Table 1, Faculty Size, Composition, and Qualifications, contains a sample report providing the information needed to judge compliance with the standards.

AACSB standards also address whether there is sufficient coverage by qualified faculty for each program and within each discipline. Table 2, Percentage Coverage of Student Credit Hours by Academically and/or Professionally Qualified Faculty by Degree Program and Discipline, includes a sample report addressing this requirement.

Similar reports to address other AACSB standards are titled, Percentage Coverage of Student Credit Hours by Full-time Faculty by Discipline, and Percentage Coverage of Student Credit Hours by Academically and/or Professionally Qualified Faculty by Degree Program and Location.

Reports such as the above, and many others have made the facts of historical practices evident. Also, they allow us to see the impact of current or projected conditions on compliance with accreditation standards. This has helped the college focus its attention on faculty qualification status, staffing levels, allocation of faculty to academic areas, scheduling of full-time and part-time faculty for courses, and faculty development needs.

LESSONS LEARNED

We experienced many of the typical problems encountered in end user system development, not the least of which was the catch-as-catch-can development process as efforts of CIS faculty and administrative staff were frequently diverted to other matters. The development effort was complicated by high start-stop-restart costs, intermittent resource availability for data entry, and a validation process dependent on faculty availability and responsiveness. We did not progress as fast or as far as we had hoped.

The project has certainly been a learning experience for the faculty and staff involved. Besides providing valuable information as intended, it has provided ample classroom examples of the difficulties of end user system development. At the time of writing, aspects of the system are still undergoing development. Revised decision rules necessitate modification, refinements in data attributes, and extensive data validation. The system will be used extensively to provide reports for the first draft of our self evaluation report due early in the Fall 1997 semester.

ENDNOTE

1. The recently revised accreditation standards o the AACSB and North Central Association are examples of this trend.

TABLE 1

SAMPLE REPORT
FACULTY SIZE, COMPOSITION, AND QUALIFICATIONS

Full-time Equivalent Faculty	F 1993	SP 1994	F 1994	SP 1995	F 1995	SP 1996	F 1996	SP 1997
1) Undergraduate Student Credit Ho	17,553	17,457	16,577	16,709	17,095	16,241	18,007	16,990
2) Graduate SCH	666	708	600	384	471	330	467	455
3) Undergraduate SCH (item 1)/400	43.9	43.6	41.4	41.8	42.7	40.6	45.0	42.5
4) Graduate SCH (item 2)/300	2.2	2.4	2.0	1.3	1.6	1.1	1.6	1.5
5) Minimum FTE faculty required (item 3 + item 4)	46.1	46.0	43.4	43.1	44.3	41.7	46.6	44.0
6) Actual FTE faculty	59.1	61.3	59.3	61.3	57.8	59.5	60.5	61.0
Full-time Faculty								
7) Minimum full-time faculty required (item 5 x 0.75)	34.6	34.5	32.6	32.3	33.2	31.3	34.9	33.0
8) Actual full-time faculty	55.0	58.0	57.0	55.0	55.0	56.0	58.0	58.0
Academic Qualifications								
9) Minimum FTE faculty required to be academically qualified (item 5	23.1	23.0	21.7	21.5	22.2	20.9	23.3	22.0
10) Actual FTE faculty who are academically qualified	41.3	44.5	43.3	44.5	40.0	41.8	38.8	30.0
Academic and Professional Qualifications								
11) Minimum academically and/or professionally qualified FTE required (item 5	41.5	41.4	39.1	38.7	39.9	37.5	41.9	39.6
12) Actual FTE faculty who are academically qualified	41.3	44.5	43.3	44.5	40.0	41.8	38.8	30.0
13) Actual FTE faculty who are professionally qualified, but not academically	7.0	6.3	6.8	7.0	10.3	11.0	13.0	13.5
14) Total FTE faculty who are academically qualified and/or professionally	48.3	50.8	50.0	51.5	50.3	52.8	51.8	43.5
Academic Qualifications with No Doctorate								
15) Maximum permitted FTE faculty who are academically qualified, but with no doctorate (item 6 x 0.10)	5.9	6.1	5.9	6.1	5.8	6.0	6.1	6.1
16) Actual FTE faculty who are academically qualified, but with no doctorate	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0

TABLE 2

SAMPLE REPORT PERCENTAGE COVERAGE OF STUDENT CREDIT HOURS BY ACADEMICALLY AND/OR PROFESSIONALLY QUALIFIED FACULTY BY DEGREE PROGRAM AND DISCIPLINE

MINIMUM STANDARD = 60%

	F 1993	SP 1994	F 1994	SP 1995	F 1995	SP 1996	F 1996	SP 1997
BS ACCT	67.8%	92.6%	88.7%	85.3%	53.9%	76.5%	73.8%	72.9%
BS BA								
Accounting	90.6%	95.0%	88.2%	97.1%	100.0%	100.0%	100.0%	58.3%
CIS	92.8%	96.3%	86.1%	95.4%	97.4%	96.6%	95.5%	86.1%
Economics	78.1%	80.0%	76.5%	79.3%	73.8%	84.3%	80.9%	71.6%
Finance	92.2%	85.9%	89.0%	100.0%	75.4%	76.1%	86.9%	75.9%
Management	52.6%	59.4%	67.6%	56.1%	61.0%	59.5%	64.0%	56.9%
Marketing	100.0%	81.5%	91.7%	100.0%	100.0%	92.5%	90.3%	78.0%
Service Courses	57.4%	47.3%	86.1%	83.8%	83.7%	86.5%	90.0%	
MBA								
Accounting	76.1%		45.8%	100.0%	100.0%	100.0%	36.8%	100.0%
CIS	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Economics	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
Finance	100.0%	100.0%	100.0%	100.0%	100.0%		100.0%	
Management		100.0%		66.7%		100.0%		65.0%
Marketing	100.0%	100.0%	100.0%		100.0%		100.0%	

USING INNOVATIVE INFORMATION SYSTEMS TECHNIQUES TO TEACH INFORMATION SYSTEMS

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Bloomsburg University

This paper discusses a number of innovative techniques the authors have used to teach courses in Information Systems to undergraduate and graduate students. While none of these techniques is individually innovative, the combination of techniques provides a true "hands-on" environment for our students; because of the way that the components of our courses are structured, students literally cannot take exams or hand in assignments without learning these techniques. The techniques discussed include publishing all course documents (syllabi, handouts, etc.) on the Web; having students use ftp to hand in all course assignments and papers; using Netscape, HTML, and a shareware product called Webforms in conjunction with Microsoft Access and Microsoft Excel to administer exams; and creating newsgroups for each course to foster communication. Benefits and drawbacks to the authors' approach are discussed.

INTRODUCTION

History as we know it is fundamentally derived from human advances through invention and education. Historical records could not exist until humans developed technologies for recording their ideas and descriptions of their deeds. We can only surmise, therefore, how prehistoric youngsters studied, or if they indeed did. When humans discovered methods of writing, the nature of education changed dramatically. Socrates developed the present protocols for education over 3,000 years ago. The teacher stood in front of the students, who listened and were free to ask questions. It is evident that this system has been in operation since that time. A thunderbolt struck educational methods with the invention of the printing press. Soon after, for the first time, students were no longer tied to their teachers' classrooms but had the opportunity to explore worlds of diverse opinions, challenging ideas, even revolutionary thought. Books were at one time considered so dangerous that mass burnings took place during the Dark Ages around the 5th and 6th centuries with knowledge only barely flickering to light again through the Renaissance.

The classroom computer may not be in the same revolutionary category as the Gutenberg Bible. Although the effects of the classroom computer have not been well understood, enthusiasts have pushed their automated classrooms as vociferously as the last generation touted the Paperless office. On the other hand, critics have pointed out that nothing can replace human instructors and that pushing technology in the classroom could engulf students in a menacing Orwellian Cyberspace. Neither of these need be true. For all our technological advances, we cannot reject the concept of a teacher and a class. Civilization as we know it today has been achieved largely because that system works.

Bromley has stated that technology has been regarded as either an autonomous external force that drives the rest of society or as a neutral tool with no impact apart from its end use. In either case, technology and society are regarded as distinct entities rather than as an assimilated whole. So it is in education. The classroom and the computer are separate or only marginally integrated. Our efforts, as described below, have been to more seamlessly integrate learning about and using information systems technologies.

LITERATURE REVIEW

A search of the literature reveals extensive work in previous research being applied in two or three areas: (1) kindergarten through high school education; (2) distance education and (3) Computer Assisted Instruction on a variety of levels. Innovative programs for children are being implemented with varying degrees of success across the country. The idea of the "virtual classroom" has led one academician to question the need for traditional forums (Crump). While the authors heartily applaud these endeavors, we believe that automated scenarios that work in school systems are not fully applicable to the mature atmosphere of the college campus; college students can generally be trusted and expected to learn independently about technology. On the other hand, the 18-to 22-year old college student - usually on his/her own for the first time in vastly different surroundings than the family nest - still requires training in those interpersonal skills that the virtual classroom cannot supply.

The authors believe that their approach to utilizing computer technology to meet the specific needs of undergraduates is fulfilling a neglected area in systems research. In the foreword for Campus Networking Strategies, Kenneth M. King, then president of EDUCOM said, "One of the grand challenges for technology in the coming decade is to create an electronic network linking every scholar in the world to every other scholar." (Arms) While those networks have now been set up and even extend beyond the academic community, there is a more pressing need to focus on effective means for using those networks to deliver improved instruction. One writer goes as far as to say that "Today's technology, if used differently, could bring advances that would improve education dramatically-illiteracy would be eliminated, ordinary students would make massive gains, and restraints on bright students would dissolve." (Bennett) The authors of this paper agree that the innovations instituted have made considerable instructional impact even if they do not share the fullest extent of Bennett's enthusiasm. A review of ERIC literature yields a number of studies on the use of telecommunications in the classroom in Teacher Education (Russett), the use of the Internet for University Freshman Composition (Bergland) and other similar studies. Many studies focus on the use of e-mail such as those of Granger and Chen from the 1995 IAIM conference.

It has also been documented that both performance and retention of college students have been improved through cooperative, rather than traditional individual, learning (Anson). Nevertheless, this approach fails to include the professor or regard the process as cyclical. The professor still lectures; the students study. Their relationship is hierarchical instead of synergistic. Our hope is to use interesting and academically valuable technological skills to slyly and surreptitiously teach our students elements of our course material. Mastering these skills does not remove the students' need for the teacher, but it does expose students to a wide range of computer skills and to today's electronic document exchange capabilities.

Apart from considerations of systems, however, there is an obvious practical application of our program. We are teaching courses in Information Systems. What better way to ensure that the student comprehends the subject than by requiring him/her to use those information systems in order to complete the course? While we reiterate that none of our techniques is innovative in isolation, their combination provides a prototype "hands-on" environment; students literally cannot take exams or hand in assignments without learning how the relevant system (e.g. Netscape or FTP) really works. Still there is a paucity of information on actual classroom tools supporting such standard tasks as testing, giving out assignments, handing in assignments, sharing learning, and extending the class hour to virtually unlimited time. These are some of what constitutes the infrastructure of instruction that we find can be addressed in part by the technology. The next section of the paper will discuss the individual techniques selected for inclusion in this paper.

INFORMATIONS SYSTEMS TECHNIQUES USED TO TEACH INFORMATION SYSTEMS COURSES

The World Wide Web — Online Syllabi

For each course we teach, we create a home page on a Bloomsburg University Web server to which we create a link from our individual home pages. Each course home page consists of an HTML frame that has a list of options displayed on the left-hand area of the screen with the corresponding selection appearing to the right. The options usually include 1) a return to the professor's home page, 2) the course description, and 3) the course syllabus. Thus, if the student picks the course syllabus, the syllabus will be displayed in the right two-thirds of the screen.

On the first day of each class, students are instructed to go to a computer lab, get into Netscape, and go to the instructor's home page. From there, students are shown how to find the appropriate course syllabus. Since no paper syllabus is handed out, students must use this resource. From the first day of classes, students are actively engaged in actually using the technology we are trying to teach them; the technology comes at them not only in the form of assignments, but also in the natural course of being students in our courses trying to get information about the courses.

FTP — Delivering Assignments

Similarly, when students have assignments or papers to hand in, they no longer submit disks or hard copy. All work is handed in electronically over the campus TCP/IP system using the File Transfer Protocol (ftp). FTP is a service that allows files to be copied from on machine to another over a TCP/IP network, such as the Internet.

Each of the authors has set up an ftp server on his office machine, which runs 24 hours a day under normal circumstances. The FTP server software chosen is called Serv-U, which is a shareware package; for a fee of about $20.00, one can get a very robust FTP server with an easy to understand interface. Using client ftp software available in all computer labs and in almost all home Internet setups, students can transmit their files at any time to the instructor's machine, using accounts set up specifically for each assignment.

Each account designates the course, the assignment, and the appropriate subdirectory for the assignment, so each assignment ends up exactly where we want it on our hard drives, ready to be graded. We have devised a system for creating User IDs and passwords for each assignment that has worked well for us. For example, if the course is 92.150 (Introduction to CIS) and the assignment is the first Excel assignment, the User ID would be 92.150.excel1. The password for the account is always the same as whatever comes after the last period in the User ID, therefore the password in this case would be excel1. Creating the account lists by assignment, rather than by individual student, saves us a lot of time and effort. However, it does mean that the students must have a system for naming their files, because duplicate filenames cannot exist. Our system is to require students to name the files they submit by their last names and assignment number. Under this system, Carl Chimi's first Excel assignment file would be called chimi1.xls. In the event of duplicate last names, the initial of the first name, or some other convenient discriminator, is used, e.g. chimic1.xls (Carl Chimi) and chimij1.xls (Jeanine Chimi). Also, if a student submits a file, but then wishes to revise it, s/he must rename the revised file using a letter, e.g. chimic1b.xls. Only the latest version of the file is used for grading purposes.

Accounts are turned off at the designated due time, so late submissions are not possible through ftp. This system has many advantages, not the least of which is that, if performed correctly, it forces the student to have a backup copy of his or her assignment. We know of colleagues who encourage file submissions via attachments to email messages, and we teach this technique in classes where it is appropriate. We feel, however that the FTP method is superior for general assignment delivery, because it puts the files right in the subdirectories on our hard drives where they belong. E-mail attachments have to be unattached and manually placed where they belong.

The World Wide Web — Online Exams

Examinations are rarely given on paper in our classes anymore. For each exam, an electronic template is created using a shareware product called Webforms. This automatically sets up an HTML copy of the exam but, more importantly, Webforms also contains functions for collecting the data for each student's exam into a Microsoft Access database, whence it can easily be graded. While this process can be time consuming on the front end for the instructor, it has many advantages. The important point is that students have to use the technology in order to take the exam (and they all learn to do it very quickly because they have to).

Webforms, like Serv-U, is a shareware package requiring a nominal registration fee (about $30.00). The interface can be a little tricky, but a familiarity with creating forms in HTML will make it easier to work with. Using Webforms, one creates the basic structure of the exam, i.e. all of the fields to be filled in (e.g. name and student number, text areas for essay questions, radio buttons for True/False or Multiple Choice questions), text to be displayed (questions, instructions, etc.), email address where the exam answers are to be sent, and submission and reset buttons. Once the structure is complete, Webforms will automatically generate the proper HTML code for the exam. Our experience is that Webforms, while very good, will not generate a completely useable HTML test; usually another HTML editor such as Netscape Communicator or the Windows Notepad is used to finalize the look of the exam.

The HTML exam file is placed on a University server that runs a World Wide Web server. At exam time, the students are given the URL for the exam and instructed to use Netscape to locate it. The students are also instructed (usually during the class period before the first exam) that their answers will be sent to the instructor in the form of an email message and that , therefore, each student must know how to set up Netscape to send email. Learning this procedure is considered to be part of the test; students are told that they must know it when they take the exam, no instruction in setting up Netscape will be given on exam day. Very few students come unprepared.

When a student is finished with the exam, s/he presses a Submit button, which sends the exam answers as an email message to the instructor's email account on a University UNIX server. The instructor monitors the server, and as each exam arrives, that student is notified. At that point the student is free to close Netscape and to leave. Students should not close the exam until they know for certain that the exam has arrived in the instructor's account. Students are also free to print their exams, if they desire.

Once all of the exams have arrived in the instructor's email account, Webforms comes into play again. The professional edition of Webforms allows the user to designate a POP3 mail server (such as the UNIX mail server mentioned above). Webforms will then go out to that server, examine all of the email messages found on it, and download each message which was generated by a file (such as the HTML exam) generated by Webforms. Essentially, it downloads each exam into its internal database. Form there, Webforms can export the data out to either a text file or a Microsoft Access database with each question in its own field.

With the data in Access, it is easy to automate the grading of True/False and Multiple Choice questions; essay questions must, of course, still be graded manually. The grades are recorded in an Excel spreadsheet and pasted onto an article posted to the class newsgroup, discussed below.

Students seem to really prefer this method of taking exams to the use of pen and paper, and they have been vocal in their preference. Somehow, once they are used to taking exams this way, the process seems to flow very quickly and smoothly. As instructors, we generally prefer to give exams this way now, but we warn our readers that there is more work involved, especially on the front end, in giving tests this way. The learning curve is substantial, but not insuperable, and the whole process is more complex than just printing and photocopying an exam. Having a knowledgeable graduate assistant who can do some of the intensive labor work involved can ease some of the pain, as can the knowledge that your students are doing the very things you want them to learn in order to do something as mundane as taking a test.

USENET Newsgroups — Course Discussions Online

The final technique to be discussed in this paper is setting up individual course-specific newsgroups for each course. A newsgroup serves as an electronic bulletin board/discussion area. Students are encouraged to contribute to these newsgroups, and participation in newsgroup discussions is factored into each student's final grade. The newsgroups have been useful for such mundane course tasks as posting due dates, hints for exams, grades, etc., but also for allowing each student to describe herself to the group, for engendering discussions about issues brought up in class, for asking questions about assignments, for answering those questions, etc. The newsgroup is a valuable tool for making information available to all.

Setting up a newsgroup for your class is relatively easy, provided you are on good terms with the people at your school who actually set up the newsgroups. At Bloomsburg University, this is the people in Academic Computing. A request to them can usually have a newsgroup set up very quickly. At Bloomsburg, a typical newsgroup for a course might be named bloomu.classes. cis.150chimi. Newsgroups in the bloom hierarchy are not available to users outside of the bloomu.edu domain on the Internet; among other things, this prevents the spamming, which is so prevalent in globally available newsgroups.

Reactions to the newsgroups have been mixed, perhaps because they are not as tightly integrated into the fabric of the course as the other technologies. Some students will use them regularly to ask questions or post hints, while others seem never to think of the newsgroups as a source for information about the course. An effort has to be made by those students initially, to check their newsgroup messages even as they check for their E-mail. Posting grades to the newsgroups, and hints for exams, seems to increase the usage, but unless a student actually posts an article to the group, it is not possible to track usage accurately.

BENEFITS OF OUR APPROACH

The current crop of undergraduates is composed mostly from the generation brought up on electronic video games, the kids who can program the VCR while parents are still fumbling through instructions. Many have had computer-aided instruction in high school, so machines are familiar to them. They tend to have short attention spans in lectures but show infinite patience sleuthing for data on the Internet. By making electronic systems an integral part of the classroom, we have found that students are less likely to be bored or distracted.

For those students who are reluctant to speak up in class, the newsgroup is an ideal pathway to true self-expression. Many instructors have found that a student who remains mum during a Q&A period will later send E-mail. Because the newsgroup is open to all, it is possible to discuss an individual's input in class without the intimidating "raising of hands." As a matter of fact, the authors have had experiences similar to the following:

> "_a woman posted a note to the group before she'd carefully composed her thoughts on the subject at hand. She regretted "peaking" too quickly, and within a few minutes had posted a retraction/revision of her previous comment. In that case, the woman was publicly going through the process of learning what she thought. The rest of us on the list (newsgroup) benefited from seeing the process."(Crump)

To pass the course, the student must have extensive knowledge of the information systems used in class. It's just not possible to skip a step or fudge a move. We have found that grade averages have improved, student enthusiasm for courses has increased, and we would like to think that each student has also achieved a higher level of self-confidence.

From the instructor's point of view, while creating an online exam has a certain level of difficulty attached to it, the automated grading is easy. Exams and syllabi no longer have to be produced far enough in advance to meet the schedules of the Duplicating Office (a major concern for at least one of the authors), and fewer trees are killed because almost no paper is used in these courses.

DRAWBACKS TO OUR APPROACH

Of course, any system that relies heavily on ancillary technologies is vulnerable to faults in or problems with those technologies. One big concern is - what if the network crashes? One has to be very flexible. For example, at the time of this writing, one of the authors is preparing to administer an online exam. The UNIX server on which the exam would normally be placed, and on which his email account resides, planetx.bloomu.edu, has been recently upgraded and is acting very erratically. Luckily, Bloomsburg University has a number of such servers, so the author has simply transferred operations over to another machine, vesta.bloomu.edu. For someone without that kind of flexibility, this could be a disaster.

Online exams are also dependent on students setting up Netscape correctly. A student may think s/her is following directions, but get one little character wrong in an address, and the exam will not arrive. Since we do not feel that it is fair to penalize students who may have answered all of the questions correctly, but failed to send the exam, we sometimes have to help students to make sure the exam arrives.

We have still not developed a foolproof method for administering exams outside the regular classroom setting. At present, students must use the classroom machines and exams are taken under the watchful eye of a monitor. Eventually, we would like to provide a testing process that permitted each student to take the exam privately within a given time frame and to provide exams that would elicit greater self-expression and provoke more individual thinking. To date, this has not been possible.

CONCLUSION

We are still perfecting the system. It has been a worthwhile exercise to work cooperatively with students in making it truly integrated. For example, when asked whether they prefer to take exams online or on paper, our students unanimously prefer the online method. We have observed how quickly students become comfortable with and confident about using computers, both Windows- and UNIX-based. The integration of the Web with our course materials has been very rewarding, and we look forward to using the tools available in Microsoft Office97 to provide an even tighter integration.

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Serv-U may be accessed at: http://www.cat-soft.com/

Webforms may be accessed at: http://www.q-d.com/wflinks.htm

PAPERLESS CLASSROOM IN INTRODUCTORY COURSES

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This paper will explore the incorporating of paperless office technology and paradigm into an Introduction to Data Processing class. It will look at our model of a multi-media classroom and discuss the implications of design decisions that we made. It will also look at the advantages and problems that were encountered.

INTRODUCTION

This past year the Introduction to Business Data Processing classes at Georgia College & State University went through more than its seemingly annual content update. More dramatic than in the past, we migrated from a Wordperfect 5.1, Lotus 1-2-3, dbase III and Harvard Graphics DOS environment to Microsoft Office under Windows 95. This is but one example of how technology changes has impacted teaching faculty.

PAPERLESS CLASSROOM PARADIGM

In the past, student work was turned in hard copy along with a floppy disk. A fairly common side effect was the transmission of viruses as our students come from a dispersed area and an increasing number also have computers at home.

Last fall quarter we tried something new. The only printed handout was the course syllabus. Most assignments and announcements were made electronically. Each student was required to have 6 diskettes.

About the 3rd class session students received a 50 minute session on email. This included taking one of their diskettes and loading Eudora Lite onto it. The students configured their disks for their accounts which had a welcome message from the instructor, a class list with e-mail addresses, a handout on how to cite material found on the WWW, and a copy of the syllabus. Successful completion of the task for the day was the establishing a connection with the mail server, retrieving the messages, making a nickname for the instructor, and sending 2 or more messages, 1 to the instructor and at least one to a classmate. Students who had outside e-mail access could request that an alternative email address be used for the class.

Academic Computer Support provided a batch file to make the Eudora lite diskette. While it was slower to access from the floppy, this provided the student with the flexibility to attach to email from any workstation on campus.

This structure gave the students additional survival skills in addition to the content of the class. Students submitted all work by e-mailing it as attachments to the instructor. One assignment also involved Zipping of files prior to sending them. After the first use of e-mail there was excitement as students came in with the email addresses of friends, parents, teachers from high school.

ASSIGNMENTS

Another component of the class was extensive use of the World Wide Web. Besides a web site of the day, students were encouraged to bring in tidbits about web sites they had heard about or were interested in. The first word processing project was a short paper about an assigned research area for software products off of the web. The second WORD project was a mail merge assignment writing to 10 companies discovered while doing their research.

Email was used to revise due dates of projects, give an outline of the content and format of exams, and return of annotated papers. The author wrote a macro to place his comments in a big font and in red type. An alternative option is to insert a comment box into the document.

Other assignments included two spreadsheets, an Access problem, and an oral presentation with Powerpoint slides. At the student's option they could make a presentation on the area they researched on the WWW or any other area they were interested in. This was the most exciting part for most students as they learned to download pictures from the web into their powerpoint presentation. This often included their favorite musician or sports athlete or scanning in their own picture. Some students who were members of fraternal organizations borrowed from the home page and others created a prototype of a home page for local organizations.

ADVANTAGES

There were many advantages to the paradigm of a paperless classroom. Among these were:

No spreading of viruses. The CONCEPT Macro virus can still be spread this way but is easily screened on most desktop virus checkers.

All work can be turned in at any time of the day and is time stamped with the time it was received at the mail server. There is no discussion about slipping under a door.

Grading can be accomplished with a couple of hours of quiet by having the class spreadsheet, eudora, and the assignment application open in different windows simultaneously.

PROBLEMS

The instructor's desktop and laptop did not have the same versions the students had in the lab. Now the instructor has leapfrogged the lab but all should be in synch next quarter.

This does not work as well for students working at home on their own computers. It takes additional time and effort to teach reformatting for the desired application packages.

CONCLUSION

Like any new technology, there is a learning curve. The instructor has the expectation of covering more content the next time the course is taught. I plan to have each student construct a small personal home page the next time I teach the class with some hyperlinks to their research sites on the WWW.

USING THEORY OF CONSTRAINTS TO TEACH INTRODUCTION TO MIS

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Teaching MIS courses is a real challenge. This paper presents a procedure called the current reality tree (which is a tool of the Theory of Constraints) and proposes a methodology to use it to aid in the teaching of Introduction to MIS courses. An example applied to the problem of meetings is presented. The methodology is currently tested at a University and some preliminary results are given.

INTRODUCTION

Teaching Management Information Science (MIS) courses is a real challenge. First, MIS draws research and principles from different disciplines (i.e., psychology, economics, sociology). As a result, instructors must master a large variety of subjects and be able to present them in a meaningful and interrelated sequence. Due to the variety of subjects, students may tend to be confused and lose focus.

Another problem comes from the fact that students coming to an introductory MIS course have different educational backgrounds (computer science, business, etc.). Therefore, students expect a different prospective as to what MIS entails. Computer science students usually expect some technological focus and hands-on type activities. Business students like to see the business and managerial implications of information systems.

Finally, students have different levels of knowledge about computers. A regular class may have students with high level of programming skills in different languages versus students who are still afraid they may break a computer if they touch it. Finding a balance in the level of technology coverage becomes a challenge.

Several approaches can be used to teach Introduction to MIS courses, including lectures and case studies. Teaching MIS courses using a lecture approach can be extremely boring for students, especially for computer science students who may be used to "do" as opposed to just listen during the whole class. Case studies are a better alternative because they allow students to do some creative work on their own. This paper offers one alternative that can be used along with case studies: the use of Theory of Constraints.

THE MIS PROBLEM SOLVING MODEL

Before explaining TOC, the following model is presented as a framework within which Theory of Constraints can be used. The model presented in Figure 1 assumes that a problem solving approach is the main focus of the MIS class and serves as an outline for the different sessions.

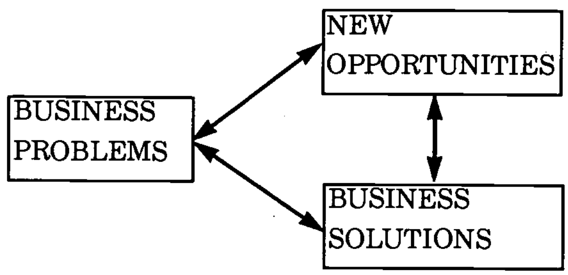
The first part of the model (business problems) suggests initiating a session by clearly defining a specific problem of a business. These problems can be within company's functions, among functions and even among firms. An example of a classical problem could be lack of knowledge about customers' needs. This is a marketing problem and it can be found at most businesses. The objective of this part is to have students understand the characteristics, magnitude and importance of a given business problem.

The second part of the model is the solution offered by information technology. In this part, a specific MIS solution to the problem is explored, analyzed and validated.

Finally, new opportunities arising from the implementation of the MIS solution can be explored. MIS solutions not only help solving specific problems but also, by their own nature, bring new opportunities to the table. This part of the model implies making students aware that Information Systems go beyond solving current problems.

FIGURE 1

PROBLEM SOLVING MODEL



THEORY OF CONSTRAINTS

Theory of Constraints (TOC) is a set of logical tools known as the thinking processes and their applications to Production, Marketing, Project Management, Distribution and Management Skills. TOC was developed by Goldratt (1990), a physicist by training. The specific applications of TOC have been reported in a series of novels (Goldratt, 1992, 1994 and 1997). Also, a study illustrating several applications of TOC was written by Noreen, Smith and Mackey (1995).

TOC tools include current reality tree (CRT), future reality tree (FRT), conflict resolution diagram (CRD), prerequisite tree (PRT), and transition tree (TRT). Most of these tools intend to represent complex systems as a set of cause-and-effect relationships. A complete treatment about these tools can be found on Dettmer (1997). In this paper, a proposal of the application of the CRT to teach MIS will be presented.

The Current Reality Tree (CRT) is a tool used to determine what is the major problem of a system. It starts with a set of problems and/or symptoms, also referred to as undesirable effects (UDE's), observed in the system being analyzed. These UDEs are then connected via cause and effect relationships. The objective is to have a logical tree where all UDEs are connected to a common cause. If this is done, the analyst can argue that the common cause is the root of most undesirable effects of the system (i.e., the core problem), and that solving or removing the common cause can help improve the system as a whole.

The CRT can be used in an MIS class to find the core problem of a specific system, and then, to demonstrate why an Information System technology approach can be part of a solution. The CRT can also be used along with case studies as part of the business problems part of the problem solving model. Using a CRT gives students a systematic way to analyze case studies. The following procedure is proposed:

1. Explain the nature of the system to be analyzed
2. Find a series of undesirable effects of the system
3. Guide the students in the construction of the CRT
4. Agree on the core problem of the system
5. Explain the corresponding IT solution

By developing a CRT, students will gain a deeper understanding of the core problem of the system being analyzed. Selling a specific IT solution may then be easier. Let's consider an example.

EXAMPLE OF AN APPLICATION OF THE CRT

Meetings

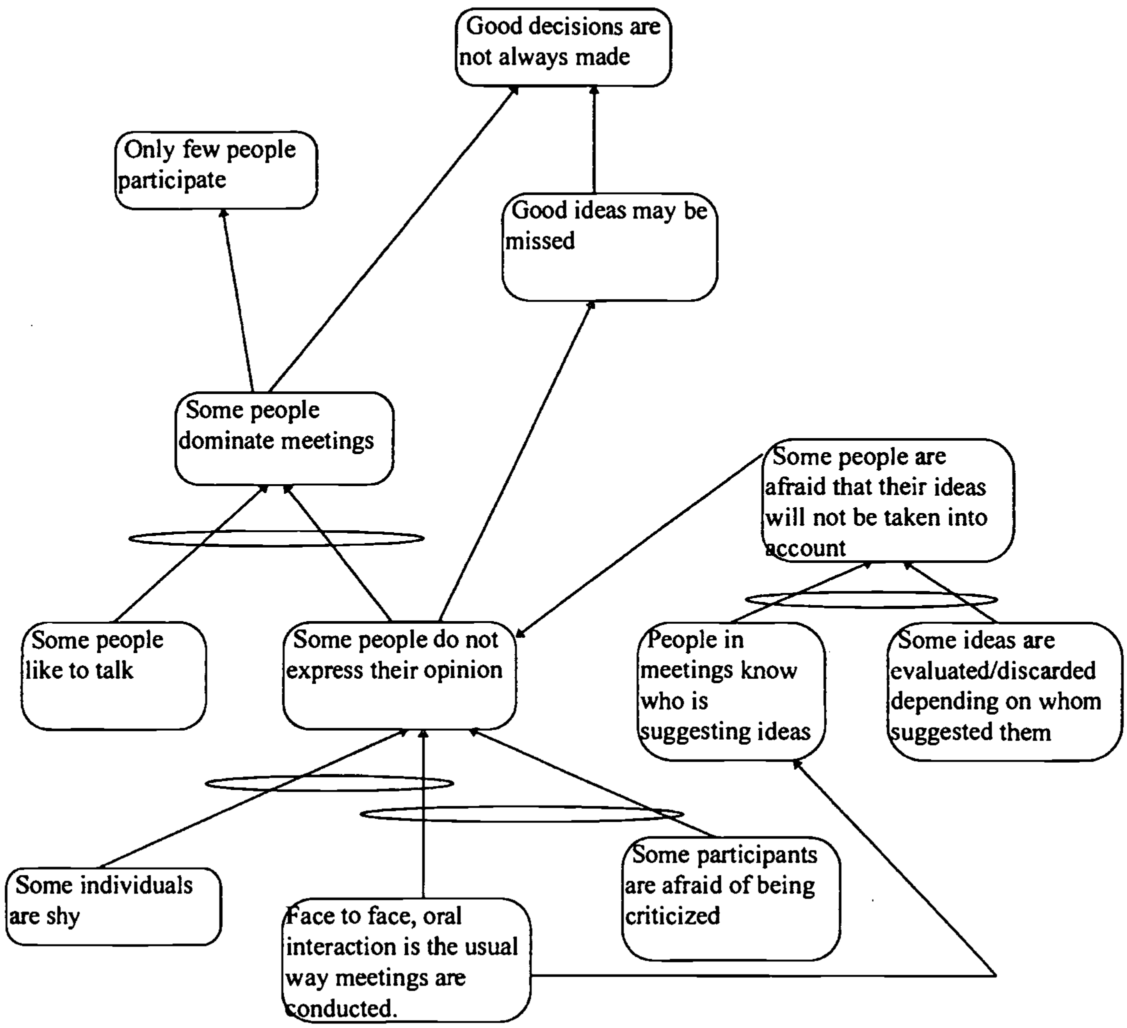
In explaining the subject of meetings within organizations, an instructor may talk about the importance of having meetings due to teamwork, etc. According to the model presented in Figure 1, the beginning of the class should be used to convince students about problems businesses encounter whenever meetings are conducted. From the discussion, students can be asked to develop a set of undesirable effects that they have observed in meetings. A potential list follows:

1. Some people are afraid their ideas will not be taken into account
2. Only a few people participate
3. Some people talk too much
4. Some people do not express their opinion
5. Good decisions are not always made

More UDEs are possible, but these are enough to demonstrate the use of CRT. Figure 2 shows a version of a CRT that could come from the analysis. The tree is read from the bottom-up. An entity at the tail of an arrow is the cause and the entity at the head is the effect. If two arrows are connected to an entity and if there is an ellipsis connecting both arrows, that means that both causing entities are necessary to produce the effect. All entities without arrows coming into them are candidates for a core problem.

FIGURE 2

MEETINGS' CURRENT REALITY TREE



As the CRT suggests in Figure 2, there are several entities (no arrows coming into them) that can qualify as core problems:

1. Some individuals are shy
2. Some people like to talk
3. Some ideas are evaluated depending on whom suggested them
4. Some people are afraid of being criticized
5. Face to face oral interaction is the usual way meetings are conducted

At least in theory, it is possible to intervene on entities 1-3. For example for entity 2, some people like to talk, it is possible to give a limited and equal amount of time to everyone in the meeting as is normally done on political debates. However, entities four and five are good candidates for core problems as they are directly or indirectly responsible for most undesirable effects. The undesirable effect coming from entity four were minimized by the breakthrough called brainstorming whereby people are not allowed to criticize an idea until enough ideas have been identified. Entity five also offers a great opportunity to improve meetings, if an alternative way can be found to communicate/ interact during meetings.

Up to this point students have agreed on the nature of the problem and they have explored some of the potential solutions as guided by the current reality tree. Hopefully, at this point, they understand that to solve some of the problems encountered in meeting a new way to interact in meetings needs to be found. This smoothly leads to the MIS solution: Group Decision Support Systems (GDSS) whereby people participate anonymously.

WHY SHOULD THIS WORK

The CRT is a hands on activity very similar to a programming job. The hypothesis is that computer science students may feel comfortable when making a tree. In addition, computer science students who may be familiar with graphical packages can help business students with less computer experience. This should promote team building.

Most undesirable effects and problems presented are related to business-related issues such as customer satisfaction, cycle time, profitability and cost. Therefore, business students can see the relevance of the relationship between the core problem, as found by the CRT, and its business implications.

Also, the causalities involved in building a CRT requires knowledge about business subjects such as organizational behavior, marketing, and personnel. For example, the problems of business meeting can be related to political implications of criticizing one's boss, etc. Business students may be more familiar with those subjects and they can bring their expertise and share it with other students.

In short, the CRT is a tool that can allow students to work in a systematic manner and combine different level of experience. Additional bonuses include the ability to work in teams and the experience of building a CRT which they can use later in their future jobs to solve real problems.

SOME RESULTS

The approach is currently being tested and some preliminary results follows.

1. It is difficult to find case studies that present scenarios where a company is trying to solve a specific problem. Most cases are solutions that have already been implemented. This makes the application of the CRT difficult.
2. Students in general find some problems when constructing a CRT. It is a little surprising the level of difficulty they encounter when asked to think using logical cause-and-effect relationships.
3. Students understand and easily follow a tree that is presented to them. Some students say that the logic of the tree is "straightforward" once is completed.
4. Some teams work fine with the trees some do not. Usually there is a dominating person who builds a draft of the tree and the other team members just scrutinize the logic.

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EVALUATING THE PLANNING OF INFORMATION TECHNOLOGY SUPPORTED CO-OPERATIVE LEARNING (ITCL) CENTRES FOR THE TEACHING OF INFORMATION SYSTEMS

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In the teaching of first year Information Systems students, it is a known fact that the students have different levels of computer literacy when they enter the university. This is specifically the case in South Africa, where large numbers of students come from disadvantaged educational backgrounds. Universities sometimes try to overcome the disparity in computer literacy by introducing bridging courses or extra classes for the computer illiterate students. The use of co-operative learning and information technology may enable the lecturers and students to cope with the demands of a first year course in Information Systems. The planning of telecentres using co-operative learning techniques is however crucial for the success of such an endeavour. This paper will therefore focus on an evaluation framework for the planning of ITCL in telecentres for students. The components involved in the implementation of ITCL at telecentres will thus be identified in the paper. A questionnaire that can be used for the evaluation of the planning of ITCL centres will be discussed in detail. In this questionnaire specific questions about the different components involved in the planning of ITCL centres will be provided to guide the lecturer in the establishment of such a centre and to help him or her to ensure that the correct ITCL environment is created.

INTRODUCTION

In the teaching of first year Information Systems students, it is a known fact that the students have different levels of computer literacy when they enter the university. This is specifically the case in South Africa, where large numbers of students come from disadvantaged educational backgrounds. Universities sometimes try to overcome the disparity in computer literacy by introducing bridging courses or extra classes for the computer illiterate students. The use of co-operative learning and information technology may enable the lecturers and students to cope with the demands of a first year course in Information Systems. The planning of telecentres using co-operative learning techniques is however crucial for the success of such an endeavour. This paper will therefore focus on an evaluation framework for the planning of ITCL in telecentres for students. Co-operative learning is an ideal learning approach to help students bridge the gap in their educational background. Information technology can enrich and improve co-operative learning if applied correctly. The establishment of a telecentre using a networking environment at a university may provide lecturers with a facility that will help them to cope better with the demands of computer illiterate students, as well as students with learning problems. Establishing such telecentres in rural communities, so that high school pupils could, besides their normal school hours, spend extra time on specific topics/subjects, using ITCL, might even have better results in bridging the educational gap that some first year students experience. Networking between telecentres at different universities can also enable lecturers and students to share information technology resources and expertise, particularly in the Information Systems field.

The components involved in the implementation of ITCL at telecentres will thus be identified in the paper. These components will include the lecturers, students, curricula, financing, information resources, technological infrastructure, as well as the non-technological infrastructure, and management. The diffusion of ITCL will also be considered in order to indicate how it can, by means of a "snowball"-effect, contribute to extended and continuous development of students. A questionnaire that can be used for the evaluation of the planning of ITCL centres will be discussed in detail. In this questionnaire specific questions about the different components involved in the planning of ITCL centres will be provided to guide the lecturer in the establishment of such a centre and to help him or her to ensure that the correct ITCL environment is created.

WHAT IS DEVELOPMENT?

Traditionally development is seen as economic progression from the primary sector (agriculture, mining and other prime productions), to the secondary sector (industries for construction and production) and finally to the tertiary sector (proving services).

According to Hobart (1993) sociologists and anthropologists have for a long time been critical of attempts to express development in true economical or technological terms and also of the assumptions on which these attempts have been based. Todaro (1989) has it that development is not only an economical phenomenon, but a multi-facet process that includes the reorganizing and reorientation of total economical and social systems: "The process of improving the quality of all human lives." This view of development is particularly of great importance to developing countries, where economic growth alone is not sufficient. Todaro points out three important aspects of development:

⇨ Life sustenance: the upliftment of people's life standard through relevant economical growth processes.

⇨ Self-esteem: to establish conditions that are favourable to the growth of people's self-esteem by creating social, political and economical systems and institutions that will better human respect and dignity.

⇨ Freedom of choice: increasing people's freedom of choice by extending the range of choice variables from which they can choose.

How can one determine whether development has taken place or not? According to Max Neef et al. (1989) development is about people and not about objects. The measurement of the quantitative growth of objects can be determined using indicators such as the gross national product (GNP) or the exchange rate. Measuring these indicators can be very easy and simple, but how does one measure the qualitative growth op people? Max Neef et al. (op. cit.) claims that the best development process is one that leads to the greatest improvement of human life quality. The indicators of development should therefore reflect on the wellbeing of the individual. The life quality of people can be improved if the human needs, which are not satisfied completely, could be identified and addressed.

According to Hobart (1993) solutions to development problems often occur against a typical Western background. The importance of understanding the knowledge within a specific context is then not taken into account and Hobart (op.cit.) claims that the growth of such knowledge will lead to the growth of ignorance. The aim of development is not always to provide a solution to the problem of development, but rather to bring about planned social and economical change. Hobart (op. cit.) arguments that: *"defining development as a problem susceptible of a solution, or pathologically as a condition requiring a cure, may well be displaced."*

Amin (1990) links up with Hobart (op. cit.) when he argues that maldevelopment will occur if development in developing countries were to take place against a Western background and if developing countries were at the same time forced to be dependent on the developed world, because of the development initiative that comes from a Western perspective. It is therefore necessary that the development initiative should come from the local community in developing countries. According to Amin (1989) delinking has to take place in developing countries. This means that the effect of external economic interactions on the internal choices of developing countries should be neutralized. The developing world has to be delinked from the logical global system in an attempt to prevent maldevelopment. A developing country should therefore be in a position to continue and control the development, which was likely to be set in motion by a Western developed country, independent of the initiators thereof.

Education can be seen as the cornerstone of social and economic development (Haddad et al, 1990). Co-operative learning disposes the necessary attributes to help with social development, because it improves efficiency in the field of education by providing a supplementary approach to education and training (Grobler, 1995).

CO-OPERATIVE LEARNING

As universities struggle with social change, new technology, a rapidly expanding knowledge base and a multicultural university population, there is an ever increasing need to help learners understand basic skills and develop higher-order thinking abilities. "The ability to creatively think and solve problems co-operatively will become more important than ever" according to Adams et al (1990 : 103). The systematic incorporation of co-operative learning methods in tertiary education could result in the restructuring of the social system in which learners develop (Slavin et al, 1985).

DEFINITION OF CO-OPERATIVE LEARNING

Co-operative learning has been given many names in educational literature, including collaborative learning, collective learning, study circles, team learning, peer-group learning, syndicates, et cetera. The following is one of the more acceptable definitions of co-operative learning:

> *"Co-operative learning is an organizational structure in which a group of students pursue academic goals through collaborative efforts. Students work together in small groups, draw on each other's strengths, and assist each other in completing the task. This method encourages supportive relationships, good communication skills and higher-level thinking abilities" (Hilke, 1990 : 8).*

BASIC ELEMENTS OF CO-OPERATIVE LEARNING

According to Johnson & Johnson (1986) co-operative learning has five basic elements:

i. *Positive goal interdependence*, which occurs when learners undertake a group task with a feeling of mutuality. This is the most important element of a co-operative learning environment, because if learners believe that they cannot succeed unless everyone succeeds, the lesson is co-operative. Two categories of interdependence can be identified, namely outcome interdependence and means interdependence (Sharan, 1990).

ii. *Face-to-face promotive interaction*, which occurs when a verbal interchange takes place where learners explain how they obtained an answer or how a problem may be solved. Individuals must encourage and facilitate each other's efforts to complete tasks and to reach the group goals.

iii. *Individual accountability*, which means taking responsibility for learning material. Individual accountability can be accomplished through group rewards that are based on individual tests, individual representations on the group project or providing incentive for the learners to work together to learn new material, but to be tested individually.

iv. *Social skills*, which involves knowing how to communicate effectively and how to develop respect and trust within a group. Learners must be taught what skills are needed for high-quality co-operation. The more socially skilful learners are, the higher the achievement that can be expected within co-operative learning groups. *"If the potential of co-operative learning is to be realised,* *students must have the prerequisite interpersonal and small-group skills and be motivated to use them. These skills should be taught just as systematically as mathematics, social studies or any subject. ... they will also increase students' future employability, career success, quality of relationships and psychological health.*" according to Johnson & Johnson (in Brandt, 1991 : 54).

v. *Group processing* to reflect on how well the group is working and to analyse the members' effectiveness and how it may be improved. The purpose of group processing is to improve the effectiveness of the group members in order to achieve the group goals and must be done by the lecturer and the learners.

These five elements form an integral part of an effective co-operative learning process. These elements are not necessarily present in less formal approaches to group work. Killen (1992) states that co-operative learning can be considered as a formalised extension of group work. Co-operative learning involves more than just putting learners together in small groups and giving them a task to complete. It also involves careful thought and attention to various aspects of the group process, such as team-building exercises and selection of a co-operative learning method. In co-operative learning, the learners must not just do something as a group, they are required to learn something as a group. The success of the group depends on each learner's learning, which makes it necessary for learners to tutor each other and not simply exchange ideas and information (Killen, 1992). In co-operative learning groups, the members are typically heterogeneous in ability and personal characteristics, while traditional groups are often homogeneous. Co-operative learning groups are observed and analysed by the lecturer. Lecturer observation and intervention seldom take place in group work, where there is no intentional co-operative learning present in the group work.

THEORETICAL BACKGROUND

After nearly three decades of research into co-operative learning, there is general agreement that co-operative methods, which incorporate group goals and individual accountability, accelerate learning considerably. These methods also have a positive effect on a wide array of affective outcomes such as intergroup relations, acceptance of main streamed learners and self-esteem (Slavin, 1991).

Co-operative learning theories are dominated by two theoretical approaches, namely that of Piaget and Vygotsky. Piaget emphasised the importance of cognitive conflicts for knowledge restructuring. Vygotsky on the other hand, did not deny socio-cognitive conflicts, but stressed the importance of internalisation of processes on a social level (Mandl & Renkl, 1992). Vygotsky proposed that a stimulating environment awaken a variety of developmental processes within the learner, leading him/her to a higher level of cognition. Such a stimulating environment can be organised using co-operative learning, according to Nijhof & Kommers (in Slavin et al, 1985). Recent research, however, indicates a move away from the accentuation of the relationship between prerequisites and cognitive results, to information processing with the emphasis on task-specific information and prior knowledge.

THE EFFECTIVE USE OF CO-OPERATIVE LEARNING

Research on co-operative learning suggests that when used appropriately, co-operative learning can motivate learners, increase academic performance, encourage active learning, increase respect for diversity, promote literacy and language skills, help prepare learners for today's society and improve lecturer effectiveness (Slavin, 1991; Slavin et al, 1985; Sharan, 1990). The effective use of co-operative learning suggests that lecturers must instruct learners about the purpose of learning co-operative group skills. They have to use active learning techniques and relate what is being learned to the learner's personal and world environment. Respect for different learning styles must be part of the design of the learning environment (Hamm & Adams, 1992). Before deciding what learning strategy to use, the objectives and general nature of the academic content of the lesson must be considered. The following are examples of situations where co-operative learning may be appropriate (Killen, 1993):

⇨ Enhancement of learners' motivation and active participation;

- ⇨ improvement of communication skills;
- ⇨ concentration on teaching a small group while other learners engage actively in learning;
- ⇨ exchanging of ideas and learning from one another;
- ⇨ limited equipment or facilities which necessitates rotation of groups;
- ⇨ engaging in detailed analysis of some parts of lesson content;
- ⇨ improvement of problem-solving skills;
- ⇨ increasing depth of learners' understanding of course content by exploring and discussing their perceptions with other learners;
- ⇨ development of positive attitudes towards course content;
- ⇨ encouraging co-operation and respect for other learners' strengths, weaknesses and the diversity amongst learners;
- ⇨ teaching learners to be self-reliant; and
- ⇨ enhancement of self-esteem and inter group acceptance.

Research on the implementation of co-operative learning methods, as recorded by Slavin et al (1985), can be summarised as follows:

- ⇨ Co-operative learning techniques can be used successfully with any type of academic task. It seems from research undertaken by Johnson & Johnson (in Slavin et al, 1985) that the more conceptual the learning tasks, the more efficient is the co-operation.
- ⇨ Co-operative groups must exhibit controversy among the group members, but the controversy should be managed constructively.
- ⇨ Learners should be encouraged to keep each other on track. The academic content should be discussed in ways that ensure the use of higher-order learning strategies.
- ⇨ Learners should support each other's efforts to achieve their goal and ensure that all the group members are involved in the discussions.
- ⇨ Co-operative groups should contain low-, medium- and high-ability learners.
- ⇨ Positive relationships and feelings of acceptance should be encouraged.

METHODS OF CO-OPERATIVE LEARNING

Co-operative learning methods are structured, systematic instructional strategies suitable for use in any learning environment. The methods are based on social psychological research and theory, but have been adapted to meet the practical requirements of the learning environment. The main objective of all the methods is always the same, heterogeneous groups working toward a common goal (Slavin et al, 1985:8). The success of all the methods of co-operative learning depends on the ability of learners to teach each other. Methods include Jigsaw, Student Team Learning, Circles of Learning and Group Investigation.

ADVANTAGES OF CO-OPERATIVE LEARNING

The advantages of co-operative learning are listed extensively in the literature (Slavin et al, 1985; Glass & Putman, 1988-1989; Sharan, 1990). The most important advantages seem to be the positive effect of co-operative learning on achievement and interpersonal and inter-ethnic relations. Augustine, Gruber & Hanson (in Brandt, 1991) are confident that co-operation promotes higher achievement, develops social skills and places the responsibility for learning on the learner's shoulders. Various authors mention the following advantages:

i. The competent implementation of co-operative learning creates conditions more conducive to higher-level learner motivation to learn, higher-level achievement for all learners and more positive social relations with peers from one's own and from other ethnic groups in the classroom, by comparison with the whole-class method (Sharan, 1990:298).

ii. Co-operative learning strategies boost individual self-esteem and encourage learners to take control of their own learning (Hilke, 1990:7).

iii. Sharing information forces information processing. Learners must relate their knowledge or skills to the other learners, which forces them to think in new ways.

iv. The lecturer can benefit from the explanations given by learners, because this gives the lecturer an insight into the learners' understanding and thinking.

v. The development of leadership and communication skills is two of the most obvious benefits of co-operative learning. Learners learn to assume authority, delegate responsibility and listen to others.

vi. The mixing of learners in co-operative groups help to break down social and academic barriers.

vii. Active participation, which is crucial for co-operative learning groups, can improve interest and motivation (Dockterman, 1991:40).

Hamm & Adams (1992) say that research has shown that co-operative learning, when used appropriately, motivates learners; increases academic performance; encourages active learning; increases respect for diversity; promotes literacy and language skills; helps prepare learners for today's society and improves lecturer effectiveness. In a study done by Glass & Putman (1988-1989) on the use of co-operative learning in lecturer education, they found that co-operative learning not only creates greater social interaction, but also makes the classroom more intellectually stimulating and productive.

OBSTACLES TO CO-OPERATIVE LEARNING

The following problems concerning co-operative learning are mentioned in the literature:

i. Lecturers have little experience of co-operative learning methods and tend to teach as they have been taught. It is therefore necessary to change teaching methods at college and university levels, before we can hope to change the school environment (Dockterman, 1991).

ii. According to Dockterman (1991: 41), co-operative learning activities threaten classroom control: "*Separating groups of students into small, unattended groups in which they are encouraged to talk to one another threatens the management of classroom behaviour*".

iii. Lectures have to be highly efficient in order to present a large amount of material within a short span of time. Lecturers with too much material to cover, will resort to the easiest and most efficient means of relaying the content, without adding an additional burden to their teaching load (Dockterman, 1991).

iv. The learner interaction in each group must be carefully monitored to avoid learners' wasting time discussing irrelevant issues (Dockterman, 1991).

v. Some learners prefer direct instruction and will have to learn how to co-operate in a group (Killen, 1992).

vi. In some instances, learners reported that they have to spend more time on a course taught by means of co-operative learning methods, than they do on traditionally taught courses (Killen, 1992).

vii. Learners find co-operative learning environments more demanding, because they have to play an active part in the learning process (Hiltz in CSCW'88, 1988).

It is sometimes imagined that a co-operative learning environment may reduce the cost of teaching. This is not true (Chung, 1991). When learners work together in groups in an organised way, then the time and effort that must go into organisation and management of the learning environment are significant.

THE DESIGN OF A CO-OPERATIVE LEARNING ENVIRONMENT

According to Collins, Brown & Newman, as quoted in Chung (1991), four dimensions constitute any learning environment. Content is important to differentiate between the types of knowledge needed to become an expert in a certain domain. Teaching methods should be designed to give learners the opportunity to observe, engage in and invent expert strategies. To facilitate the development of problem-solving skills, the lecturer should understand the sequencing of both integration and generalisation of knowledge and complex skills in the learning environment. Certain aspects of the social organisation of the learning environment encourage productive beliefs about the nature of learning and expertise.

Johnson & Johnson (1986) suggest five major tasks that the lecturer should address when designing a co-operative learning environment:

- ⇨ Clearly specify the objectives for the co-operative learning session.
- ⇨ Decide about the placing of the learners in groups before the start of the session.
- ⇨ Carefully explain the task, goal structure and learning activity.
- ⇨ Monitor the effectiveness of the co-operative groups and intervene when necessary to provide task assistance or to increase the learners' interpersonal and group skills.
- ⇨ Evaluate learners' achievements and help them to discuss how they co-operated with one another.

In a co-operative learning environment, changes take place in the role of the lecturer and learner, and in the organisation of the classroom. These changes will be discussed when discussing the components involved in ITCL.

INFORMATION TECHNOLOGY SUPPORTED CO-OPERATIVE LEARNING (ITCL)

An ITCL environment exist when the instructional use of information technology is combined with the use of co-operative learning strategies (De Villiers, 1995), as discussed in the previous paragraph, to form a totally new environment. Information technology that can be used in a co-operative learning environment include the following: well-structured computer-assisted instruction, computer-mediated communication or electronic conferencing, interactive video, multimedia and hypermedia. Interactive video combines the best features of instructional video and computer-assisted instruction. Multimedia is the intersection of computers, sound, video and animation. Hypermedia can help lecturers by being a non-human information provider, which can leave the lecturer to fulfill the role of facilitator, mentor and coach. McConnell (1994) also mentions bulletin boards and online databases, although no examples of these are given.

THE DIFFUSION OF INFORMATION TECHNOLOGY SUPPORTED CO-OPERATIVE LEARNING

The successful implementation of ITCL is a prerequisite for the acceptance and diffusion of technology intervention. Leonard-Barton (1988) describes transferability as a needed condition for the implementation of a new technology. According to her, transferability consists of two dimensions, namely readiness and communicability. Readiness refers to the degree in which the technology has proved its feasibility. ITCL has already proved that it is a feasible teaching method. The second dimension of communicability refers to the degree in which the "know-how" of the technology and the underlying scientific principles, "know-why", are communicated to the people. Communicability of a technology can be determined by the availability of formal training for the people. The implementers of information technology must take the educational level, the cultural nature and the general perspectives of the users into account during the implementation process (Froneman & Roode, 1996). If we look at ITCL as an innovation, then diffusion of ITCL will only take place if it is accepted by the organisation, in this case the university, and if it is to the advantage of the organisation. If universities do not accept ITCL, it will not diffuse throughout the tertiary education system. The diffusion of ITCL will be greatly advanced if all the universities are linked via a wide area network. This is already in place in South Africa using the Uninet network, which also provides a link to the overseas universities.

TELECENTRES

International community centres (telecentres) are created as a method to help with the social, cultural and economic development of rural communities. Telecommunications and information technology provide access to a wide variety of information resources for communities and, at the same time, satisfy a wide range of education and training needs. A telecentre can be defined (Qvortrup, in Grobler, 1995) as a manned local centre which provides access to computer and communication tools for local communities in rural areas. A telecentre helps the people to get access to telephones, distance education, courses and meeting facilities. Telecentres can be divided into the following components: users, personnel, infrastructure, services, location, finance and the representative body (Grobler, 1995). It is important to analyse each of these components when planning such a centre.

The community centre concept can be used in developing countries to address the educational problems of those countries. It can be used to enhance the availability of education and training using telecommunications and information technology to provide teaching opportunities to lower-income communities. The effectiveness and efficiency of training and education can be enhanced because these centres make it possible to share resources.

THE COMPONENTS INVOLVED IN DEVELOPMENT PROJECTS WITH ITCL AS UNDERLYING PRINCIPLE

The components involved in development projects with ITCL as underlying principle, is illustrated in Figure 1. This is done in order to set up a framework in the form of a structured questionnaire that can be used to evaluate such projects.

A telecentre provides an ideal opportunity to propagate education for development. In such a centre education can be improved with the aid of technology, by integrating educational technology with groupwork. In figure 1 an information technology supported telecentre for co-operative learning forms the centre point of the development project to be implemented. The co-operative learning environment in such a centre could be established according to the framework of De Villiers (1995).

The components involved in the development project and therefore also involved in ITCL will be discussed on the basis of figure 1.

Lecturer

The role of the lecturer in a co-operative learning environment is to operate as a mediator by means of dialogue and co-operation. This process is difficult and requires certain skills. According to Chung (In: De Villiers, 1995) the lecturer has to facilitate the learning and has to act as a coach. In order to accomplish this, the following tasks should be executed (*op. cit.*):

- ⇨ Control the group dynamics, which involves determining the group size and group composition, fostering group cohesiveness, determining spatial arrangements, maintaining effective communication and facilitating effective leadership.
- ⇨ Keep the groups on track, by initiating discussion, giving information, seeking information, giving opinion, orienting and co-ordinating.
- ⇨ Unify each group by offering encouragement, mediating disputes, reaching a compromise, fostering communication and energising learners.
- ⇨ Organise the class, which involves space, materials, equipment and learners, co-ordinating activities, monitoring individual groups and the whole class.
- ⇨ Supervise group work by means of monitoring, tutoring, leading discussions, consulting, counseling and evaluating.
- ⇨ Be available to work with individual learners or groups while the rest of the class is involved in group discussions.
- ⇨ Have the opportunity to observe the thinking process of the learners, for example where they get stuck, how they misinterpret definitions, et cetera.

When co-operative learning is implemented in an environment where the learners were previously used to a well-structured one-to-one approach, it can lead to disaster in the classroom. The lecturer should therefore be aware of that and should be able to foster strict control and management of the learning activities.

Like any other new teaching concept, co-operative learning requires training, exercise and repetition over time, before becoming present-at-hand. Direct training of lecturers in the use of co-operative learning is therefore a prerequisite for the successful implementation thereof. To get the best results, the lecturers should be trained in a co-operative learning environment on how to use this approach. In such a situation the lecturer can experience co-operative learning as a learner and can discover what is expected and required of the learner when implementing the approach in the classroom.

Not only do lecturers have to be trained in the use of co-operative learning, but they also have to be familiar with information technology support. They have to be able to use information technology support in the preparation of their lectures and in the classroom environment, while they assist the learners in using it at the same time.

In developing countries the lecturers, of whom it is expected to use ITCL, may be totally computer illiterate. If they are caught unprepared, the social structure emerging from the technological intervention can lead to inconvenience, a demotion in self-confidence and anxiety. If the social structure, emerging because of the intervention of information technology support, is approached wrongly, ITCL can be seen as a failure.

The total support of the lecturers can be seen as the key to the success of the technology intervention. The social structures discussed above can lead to lecturers that refuse to apply ITCL in their teaching environment and that offer resistance to the planned change. Preparing and training the lecturers can therefore be seen as a first investment step in an attempt to make the technology intervention a success.

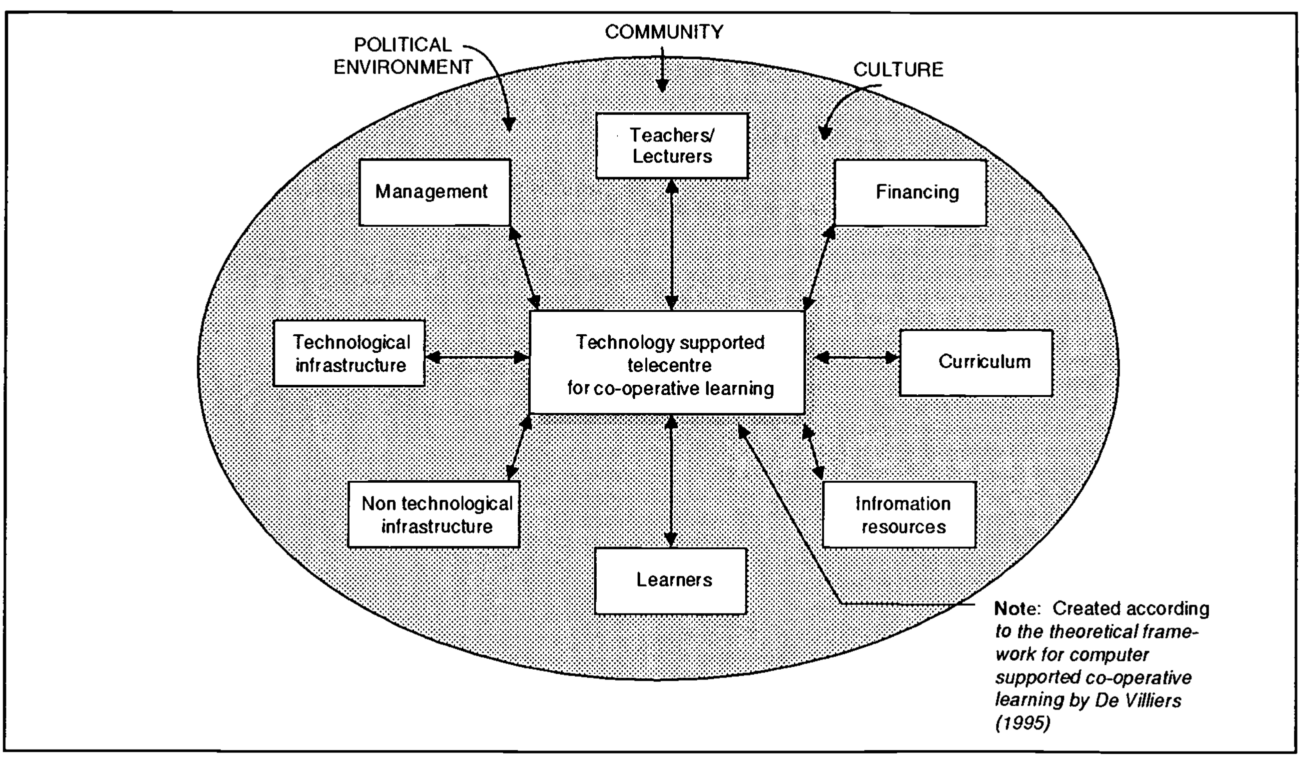
If lecturers refuse to implement the technological intervention, because they find it uncomfortable, incipient adoption and eventual diffusion of the intervention will not take place. Facilitators can be used to assist the lecturers in identifying and using information technology support for specific situations, but if the lecturers are not able to learn the skills and abilities, this process will not lead to real social development, because the lecturer will always remain dependent on the initiator. He/she will therefore not be able to continue the change in future without any help or assistance.

Learners

Learners need to assume new roles in a co-operative learning environment, namely those of collaborator and active participant. Learners share rather than compete with other learners

FIGURE 1

THE COMPONENTS INVOLVED IN DEVELOPMENT PROJECTS WITH ITCL AS UNDERLYING PRINCIPLE.



and have the opportunity to act as both lecturer and learner. To be able to assume this new role:

⇨ Learners need to learn to teach each other and be able to explain, demonstrate and develop their understanding of a concept/topic/subject.

⇨ Learners must undergo a major shift in values and attitudes. Attitudes must change from individual ownership of ideas to co-operative work (Adams et al.,1990).

⇨ Learners have to become tutors, expert consultants, investigators and presenters.

⇨ Learners must each make a unique contribution to the group, due to the equal status among learners in most co-operative learning environments.

In the traditional classroom learners are taught that the lecturer is there to validate their thinking and direct learning. It will take time for learners to overcome the passive role that they used to play. A co-operative learning environment requires more group time of a learner. The learner may experience the whole process as slow and tedious and has to be informed of this beforehand. A positive side is that learning now takes place during the class and not only outside the classroom.

In the traditional learning environment communication, problem solving and decision skills are required from learners. Adding information technology (in the form of computer support) to this environment will extend the required skills to, among others, include keyboard skills. Extending the environment further to an ITCL environment, will except for the previous mentioned skills, also include advanced communication skills and co-operative learning abilities.

Bringing information technology into the learning environment may also lead to the learners feeling uncomfortable and threatened by the technology. They may even offer resistance to the change. The social structures flowing from this intervention should therefore be approached correctly and learners should be taught to apply the technology as a mean to reach their learning objectives. The learners form part of the receivers of the new learning process and of the information technology intervention. Their level of competence should therefore also be taken into account when "moving" the technology for real social development and delinking to take place.

Curriculum

The quality of the curriculum is essential for the effectiveness of any technological application (Lockheed, et al., 1991). In achieving an educational objective the specific medium used to convey the message, is only as effective as the message (content) and the cleverness/skill with which the medium is applied to communicate the content. No tools/technology, no matter how sophisticated, can guarantee good education with poorly prepared course material.

Lecturers should not hope to improve the existing curriculum by adding information technology or co-operative learning - the curriculum should be replanned to provide for this. More time should be allowed for co-operative learning and the learning objectives should be well defined. Through this the lecturer can be sure that the relevant study material is covered and the learner can monitor his/her own learning as well as the learning of the group.

The culture, the ethnical group, skills, ability and the learners' frame of reference should be taken into account when designing computer based lectures and evaluation (Grobler, 1995).

Non-Technological and Technological Infrastructure

The non-technological infrastructure includes the buildings, like a community centre, that consists of the necessary lecture halls within which ITCL environments can be created. Although the desks and chairs in the traditional lecture hall are not ideal for grouping learners, it can provisionally be seen as adequate and no additional expenditure need to be incurred to change it.

For lecturers to get used to the information technology they have to apply in the learning environment, they have to have invariably access to information technology support (like computer hardware and software). An infrastructure that will put lecturers in a position to experience information technology support, so that they will be able to implement it in the classroom, has to be identified and put into place.

The existing infrastructure like telephone lines, electricity and fax machines can initially be used to facilitate the communication process, without additional costs. The infrastructure can be expanded in phases, starting with a computer network structure in a community centre and expanding it across the country and later even to other countries.

Management

According to Odedra-Straub (1995) development initiatives in developing countries should come from the local community. The community centre, and therefore also the development project with ITCL as foundation, should be managed by the community. It is thus the responsibility of the management selected by the community, to decide upon the courses/subjects to present and to determine the time, period and place to educate the lecturers on co-operative learning methods and the use of information technology. They may use the facilitators to guide them, but they have to gain benefit from the development process started by others and they should be able to continue with it and control it in order to prevent maldevelopment (Amin, 1990) and to ensure that delinking (Amin, 1989) takes place.

Financing

The development project should include the financial support of suitable institutional entities. A project, which depends greatly on foreign assistance, can fall to pieces if the support stops with no alternative domestic resources available to take over the financial burden. If the government is financially tied to the project, it will also have a stronger institutional commitment to the project.

The ideal is for the community to invest in the project. The concept of community centres is community driven. It can encourage the community to invest in human capital and through this in their own future.

Information Resources

The full support of the lecturers provides the key to a successful technological intervention. Facilitators can be used as information resources to assist lecturers in the identification and usage of co-operative learning methods and information technology support for a specific situation. Other information resources could be the library, or even the Internet. Learners and lecturers need this information to assist them in the education and learning process.

Community, Politics and Culture

A development project is implemented in a specific community with a definite political structure and culture. Information technology is not only culturally dependent, but also culturally defined (Postman, 1993). In order to 'move' ITCL to developing countries in a meaningful way, the culture of the receivers should be taken into account. The information technology used has to be culturally acceptable to the community within which it will be implemented and it should address and take account of the specific needs and unique situation of the community.

Socio-cultural aspects affect political acceptance. The language used in the project can be a problem in a country where more than one language is important. Cultural, religious and ethnic traditions can also be stumbling blocks in a country with great diversity.

WHY IS IT IMPORTANT TO EVALUATE ITCL FOR DEVELOPMENT?

According to Ely and Plomp (1986) there are several aspects that contribute to successful and unsuccessful projects. Unsuccessful projects have often been the result where objectives for using information technology were not clear. People using it often see it as a method instead of a systematic approach to education for development. In some cases the equipment used is seen as more important than the design of the program and the compliant course material. Some people experience information technology as a threat and resist changing. The receivers of the technology intervention may experience a lack of support if no support system was set up and if no extra time was included for training in the use of the technology.

Change programs with regard to education in developing countries are often extensive projects with national, social and economic objectives. Verspoor (1989) warns that such projects can easily fail if the implementing thereof are not planned and managed well. Extensive projects function on a basis of guidelines and procedures, which are applicable in general. It is therefore not designed to fulfil specific requirements of a unique situation. Successful change programs have to aim at local acceptance within a framework of nationally defined change objectives.

In paragraph 7 attention was paid to the implementation of a development project based on ITCL and more specific to the components involved in the implementation thereof. Attention was paid to aspects needed for the successful implementation of each component. This framework for implementation will therefore be used to set up an evaluation framework, which can be applied to evaluate the planning of a development project based on ITCL.

A FRAMEWORK FOR EVALUATING ITCL FOR DEVELOPMENT

A framework in the form of a questionnaire will be structured according to the components set out in figure 1. This framework can be used to evaluate development projects based on ITCL before the implementation thereof.

A Structured Evaluation Questionnaire:

Section A

Evaluating the components involved in the implementing

1. **The lecturers**
   - 1.1 Are the lecturers prepared and trained for the implementation of a ITCL environment? How will this be done?
   - 1.2 Are the lecturers familiar with the technology to be used?
   - 1.3 Are the lecturers familiar with the skills and competencies required to utilize and implement a ITCL environment?
   - 1.4 Do we understand the existing social structures before we implement ITCL, so that we can observe and try to understand the impact of ITCL?
   - 1.5 Will the lecturers be empowered to continue using the ITCL environment after the initial pilot period? How will this be done?
2. **The learners**
   - 2.1 Will learners, used to a more passive learning environment, be given time to adapt to the environment of groupwork?
   - 2.2 Will learners be given training about co-operative learning, preparing them for the ITCL environment?
   - 2.3 Are learners at least functionally computer literate?
3. **The curriculum**
   - 3.1 Does a curriculum, which is specifically designed for an ITCL environment, exist for the teaching of the various subjects?
   - 3.2 Does the curriculum provide enough time for co-operative learning?
   - 3.3 Is there enough course material/software for use in an ITCL environment?
4. **Non-technological and technological infrastructure**
   - 4.1 Is there an adequate infrastructure where the ITCL environment could be created?
   - 4.2 Is there electrical power available?
   - 4.3 Is there a computer laboratory to which the lecturers will have access, preparing them for the ITCL environment?
   - 4.4 Is there an existing telecommunications infrastructure, in the form of telephone lines that can be used to support the communications process from and to the learning centre, without any additional costs?
   - 4.5 Will it be possible to link this telecentre to other similar centres?
5. **Management**
   - 5.1 What has been the involvement of the local community in the establishment of the telecentre?
   - 5.2 Does the community manage the telecentre? Will the community manage the development project, built around the ITCL approach?
   - 5.3 What will be the involvement of the community in determining which subjects to teach at the centre, what ABET to provide, and how to prepare lecturers for supporting and using the ITCL environment?
6. **Financing**
   - 6.1 Is there adequate funding for the implementation of an ITCL environment

and all ancillary infrastructure and preparatory work?

6.2 Is there adequate funding for the continued operation of the project beyond the initial pilot phase?

6.3 What financial responsibility will the community take for the project and its eventual continued operation?

7. **Information resources**

7.1 Will lecturers have access to the necessary information and support resources to enable them to use ITCL in specific situations?

7.2 Will lecturers have access to other information resources such as libraries and the Internet?

8. **Community, politics and culture**

8.1 Will the technology intervention be culturally acceptable to the community and persons involved in the teaching and learning process?

8.2 Does the project address specific needs of the community?

8.3 Does the project recognise any specific, unique aspects of the community where it will be implemented?

8.4 Will it be possible to use ITCL to enrich the current teaching/learning process, given the particular circumstances within the community?

Section B

Evaluating the total project

1. Are all the components involved in the implementation of ITCL evaluated using Section A of this framework?
2. Is the project cost effective and feasible?
3. Is the ITCL pedagogically suitable for solving the education problems in the community and will it therefore meet the requirements of the lecturers and learners - is it a suitable medium to convey the content?
4. Is there sufficient administrative manpower for implementing the control over and the maintenance of the project?
5. Is the environment in which the project will be implemented well planned and designed?
6. Is the reason for applying ITCL clear to all the participants? Do they understand that it is not only a method, but also a systematic approach to education for development?
7. Is the climate set for change, with the necessary social support systems to support the individual in accepting the technology intervention?

A similar structured questionnaire can be set up for evaluating the implemented project. The following are examples of questions to be asked in such a questionnaire:

⇨ Do learners experience the technology based learning as a method of education that eases up the learning process?

⇨ Did the curriculum provide for the culture, ethnical group, skills, abilities and frame of reference of the learners?

⇨ Does the project contribute to the social development of the community and therefore to the supplying of life sustenance, self esteem and freedom of choice and does it improve the quality of human lives?

CONCLUSIONS

Human resources form the fundamental basis for the wealth of nations (Harbison in: Todaro, 1989). The current education system in South Africa cannot fulfil the education and training requirements of its exponential growing workers corps while the investment limit possible in the national budget is already reached. It is necessary to allocate the existing resources in another way in order to satisfy the requirements more efficient and effective by investigating in alternative ways for example in technology for supporting education and training (WGTSET, 1994).

ITCL implies a specific information technology intervention and the application thereof in the education and training environment. The successful implementation thereof is a prerequisite for the acceptance and diffusion of the intervention. The framework set up in this paper, attempts to ensure the successful implementation thereof, as a contribution to the "process of improving the quality of all human lives." (Todaro, 1989).

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EVALUATION AS LEARNING: COURSE EVALUATION AS PART OF THE LEARNING PROCESS

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This paper describes an example of a course evaluation where the evaluation process becomes an important part of the learning process. The setting is an action-learning based course in an executive program. The participants apply a framework for perceiving processes to their own learning process. The framework is presented and experiences from the perspectives of the participants and the instructors are described and discussed. Tentative conclusions are drawn from the experiences of using this type of course evaluation, including the following examples: Make a clear distinction between the learning processes of the instructors and the ones of the participants; Put the responsibility for the evaluation of the learning process with the individual; Design the evaluation process in concert with the course contents. Finally, there is a general discussion on how evaluation can be used as a lever of learning.

INTRODUCTION AND BACKGROUND

Often the evaluation process of a course is considered as a process following the actual learning process. In this paper an example of a course evaluation is described and discussed where the evaluation process is an important part of the learning process in itself. Having experiences from traditional forms of course evaluation where the participants are to fill out forms to rate different aspects of the course, we (i.e. the instructors of the course) wanted to move to something else. Our experiences were that this traditional kind of course evaluation seldom are useful for the instructors, and even less useful for the participants. They are usually kindly asked to spend a few minutes of their time to fill out some forms in order to help the instructors to improve the course for future participants. Some people tend to spend much effort trying to answer the different questions, while other very quickly answer the different questions: if they "like" the course in general terms they give a high grade in all different categories, or if they did not like the course, vice versa.

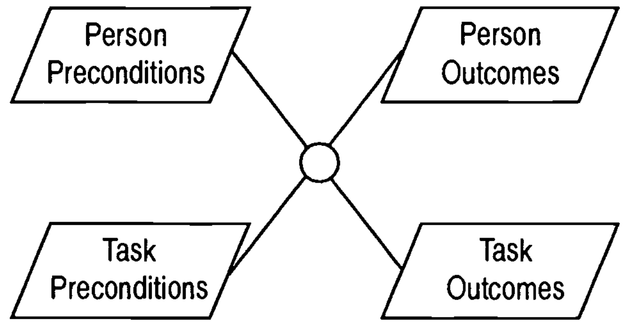
With a traditional approach we as instructors ask the participants for help in our learning processes. We want to learn more about the course and about how the next version of it could be improved. One problem though, is that a traditional evaluation form (with graded scales like 1 to 5, A to E, or similar) is not very helpful for our learning. How should I improve the course and/or my performance based on the results from the evaluation? The figures do give important information regarding how the participants' perceived the course, the performance of the instructors, and to some extent how much they learnt and/or how useful they perceived the course and its contents. In our experiences, these results from course evaluations are not always very helpful for our learning, for the participants´ learning, or for the improvement of the course. The outcome may include ideas of areas where there are particular needs for improvements, but what do we know about the quality of the results, about the actual learning of the participants?

We decided to start using another type of course evaluation, where we moved away from this traditional form of course evaluation. (Worth noting is that there are of course different types of course evaluations. For the purpose of this discussion, I talk about "traditional" course evaluation, which means a number of questions there the participants can rank the course and the instructors on a graded scale.) We aimed at a course evaluation process where both the participants and we as instructors could learn something. We wanted to offer the participants something helpful and useful for their own learning processes, and not only ask them to help us to help future participants.

The result of our efforts was to make use of one of the models for perceiving change processes that the participants had used during the course. Before discussing the setting for this work and the findings from this evaluation process, the next section will describe some theoretical links for our attempts to find forms for evaluation as part of the learning processes of the participants.

FIGURE 1

THE X-MODEL



THEORETICAL LINKS

A Framework for Perceiving Processes

The course evaluation presented here is an attempt to link the evaluation process to the learning processes of the participants. An important additional aim is to produce valuable input for the instructors' learning processes. The form, as described above, is to let the participants reflect at the end of the program. The use of the framework in this reflection enables the participants to reflect on two different levels: on both a task and a person level. In the program several models for handling change processes are used, most of them described in Lundeberg (1993). The model used for the evaluation is a framework for perceiving processes for the input and output of a process and is called the "X-model" (Lundeberg, 1993, section 1.22), see figure 1 below.

The essence of the X-model is: Each process in a business firm includes personal behavior and task processes in an inseparable whole. The main idea behind the framework is to take both personal behavior oriented and task oriented matters into consideration in a change process.

Action and Reflection

The importance of combining action and reflection (see e.g. Schon,1983) is a crucial point in the program where we introduced the course evaluation. Kolb (1984) discusses this combination in terms of "two dialectically opposed modes of transforming experience, one via intentional reflection, the other via extensional action". In order to include both components of action and reflection in our program, the participants work in cross-functional teams in customer projects to accomplish action. For the reflection, the participants use different types of reflection instruments during the program and especially the evaluation process at the end of the program, focussed in this paper.

The combination of action and reflection is one important dimension, another is the combination of theory and practice (see e.g. Argyris and Schon, 1974). In our program the practice-part is the work with customer cases. The theory used is presented at seminars and applied in the customer cases. The reflection will then help the participants to learn from the theory and practice combined. There has to be a willingness to learn though. Schein (1992) describes this like: "Learning and change cannot be imposed on people. Their involvement and participation are needed diagnosing what is going on, figuring out what to do, and actually doing it."

One purpose with the evaluation described in this paper was to find a way for the participants to reflect on their actions and learn. Then this in turn would produce valuable input for the improvement of the program. The difficulties for managers to reflect is illustrated by Senge (1990). He describes experiments which have shown that even if there is time for reflection most managers do not reflect carefully on their actions, but think about strategies for their next action. Here, we tried to build in reflection in an "action item", i.e. the "reflection assignment" every participant has to do before the concluding meeting.

At many educational institutions there is a move from traditional teaching towards new forms of teaching in order to improve the learning. Cowen (1996) describes some aspects of this change process at one major business school. When discussing a learning perspective he says: "the most important point about a true learning perspective is that is may require a wholly different approach to how business schools teach and organise themselves". When trying to break old structures at Weatherhead School of Management at Case Western Reserve University, they, among many other things, introduced new student assessment arrangements and learning plans (Cowen, 1996).

In the next section, the setting for our new course evaluation is described. First, there is a short general description of the course, then the section includes a description of the evaluation of the course evaluation.

THE SETTING

The "Course"

The course is an action-learning based competence development program within the area of Information Management in an executive program. The focus of the program is on handling change processes, and in this particular setting, change processes in the sales-relation with customers. The participants are from the telecommunication industry and each program has 15-16 participants forming three to four customer teams, with one account manager responsible for each team. The other team members come from different units within the organization. By working in cross-functional teams during the program, the degree of mutual understanding and sense of a common mission is strengthened.

Some key issues of the program are:

- It is an "in-house" program within one organization.
- Executives are involved in the program and participate when the projects are discussed.
- There is a "real-life" context, i.e. the participants are to achieve business results in their customer cases.
- Projects in cross-functional teams are in focus.
- Methods and models are included as support for the teams´ work with their projects.

The teams work on projects together with their customers and their mission is to achieve business results from the projects during the program, which runs over a time period of about three months. The cross-functional projects are in focus in the course, and the project work is mixed with theoretical seminars aimed at supporting their work in the projects.

The first step is that every participant produces a personal development plan which is discussed with her/his superior. Then there is a 2½-day kick-off for the program where the working methods are introduced and applied to prior customer cases (including video-taped sessions). The program then consists of three full-day meetings with one month´s interval, where the customer cases are reviewed and discussed. The executives are present at these meetings. Each team has prepared and distributed a written project-report to all other participants in advance of each meeting. Between these full-day meetings there are half-day meetings held where methods and experiences of the participants are discussed. These seminars may include theoretical moments judged to be important to support the customer cases.

The design of the program is briefly described in table 1.

TABLE 1

THE DESIGN OF THE PROGRAM

TIME	ACTIVITY
	A personal development plan is produced by each participant in cooperation with her/his superior
2½ days	Kick-off for the program
1 day	Process-meeting 1: All customer cases are discussed
½ day	Seminar for theoretical presentations and exchange of experiences: Models and frameworks are presented, applied and discussed with links to the customer cases
1 day	Process-meeting 2: All customer cases are discussed
½ day	Seminar for theoretical presentations and exchange of experiences: Models and frameworks are presented, applied and discussed with links to the customer cases
1 day	Process-meeting 3: All customer cases are discussed
	Follow-up discussion with superior
½ day	Concluding meeting: The final reflective assignment ("course evaluation") is discussed and linked to the results in the customer cases

At the end of the program each participant meets her/his superior to follow-up on the personal development plan. Then before the final concluding meeting each participant is asked to apply a framework for perceiving change processes (the X-model) on their own learning process during the program. These descriptions of the learning processes of the participants are then summarized (anonymously) and discussed at the last session.

Finally, a short note on why this section was named the "course" within quotes. We did not call it a course, but a "competence development program". The word "course", we found, to some people meant going away from work, as a sort of break. We wanted to have close links to the work with the customers and participants who felt that the time spent at the program was their work, although with a special learning focus.

Using the X-Model for Evaluation

At the end of a program we ask every participant to apply the X-model, which they by this time are familiar with from the program, on their own learning process during the program. This means that the focus of the evaluation process is put on their own learning processes. They have to build the description of their learning process with the help of the model and are not given any specific questions to answer. Their descriptions include their expectations, the process during the course, the lessons they have learnt from the course.

Before the concluding meeting every participant send their "X-model" to us and we combine all X-models from the participants into one document. In the process to combine the models we remove all names to make it anonymous. (One reason for this is to reduce the risk that their X-models would be restricted by the fact that their superiors read the summary of all X-models.) The document based on all the participants´ X-models is then distributed and discussed at the concluding meeting. This means that there is a discussion at the end of the program where the learning experience during the program is discussed and different participants can compare their own learning experience with other persons' experiences.

Evaluation of the Evaluation

Our own experience, is that this form of evaluation has worked very well. The participants spend time and efforts in the reflective assignment to apply the X-model to their participation in the program. Some of them have made comments on the usefulness of actually sitting down, reflecting on the learning experience.

In order to get a better picture than just our general impressions about the usefulness, we wanted to receive more feedback from the participants about their opinions about the evaluation. Therefore, we conducted telephone interviews with the participants about two months after the program. 13 out of the 15 participants of the program were interviewed.

(One was on a leave and the other person had moved.) By giving them time before asking questions about the evaluation process we reduced the risk to mix up their own learning process on one hand, and the course process on the other hand. The interviews included questions both about the program in general, questions about the role of the evaluation, and their perception of the links to their learning own processes.

By asking about the program, we had the opportunity to compare the findings from the interviews by the outcome from the X-models. That is, would the interviews after the completion of the program add much know knowledge or not?

FINDINGS

Participants' Perspective

The participants describe their participation in the program using the framework described above (the X-model). This means that they reflect on preconditions and expectations both regarding their own situation (person-level) and regarding the customer case their team worked with (task-level). They also reflect on the process, that is, both the process at the meetings and the process during the work in the team. Finally, the participants reflect on the outcome in terms of their own learning (person-level) and business results from the customer case (task-level).

On the personal-oriented level, participants often emphasize development of personal skills which improve their handling of different customer situations and of developing relationships and business with customers. Concerning the customer cases they often mention to what extent these have been brought forward during the program. Below, a few examples of comments from the X-models are presented.

Preconditions

"I had high expectations on the program where I expected to learn new methods for working with customer projects and at the same time meet colleagues from different teams and exchange experiences." (person-level)

"I saw the program as a challenge and as a step in my personal development as a salesman." (person-level)

"The expectations of the program were very blurred." (person-level)

"To work with 'real' cases was great, and to me our customer case was very exciting, as I have other similar cases." (task-level)

Process

"The process-meetings improved over time. We went from organized chaos to organized meetings with focus on specific questions."

"The design of the process-meetings with observers led to valuable comments after the meetings."

"The strength of the program is the common group where similar customer cases can be discussed with persons with different knowledge and experiences."

Outcomes:

"The importance to stop for a while and think about purpose and objective, both for a specific meeting and for a project in general." (person-level)

"I thought that the customer cases should be in another phase - the reality was not like that - processes in business cases in our organization take time!" (task-level)

"A structured approach to customer-related work." (task-level)

"An increased understanding of the process approach." (person-level)

Before the concluding working-meeting we (i.e. the instructors) combine the X-models into one document (as described above). This means a document consisting of about 10-12 pages with comments sorted in person- and task-levels regarding preconditions, process, and outcome. When this document is discussed at the concluding meeting, both personal learning and business results in the customer cases are included in the discussion. At the concluding meeting there are possibilities for the participants to compare their reflections, and to discuss how to continue the learning process after the program. What then do we learn from this as instructors? This will be discussed below.

Instructors' Perspective

The document describing all participants' reflection of the program gives a very rich picture of several different dimensions. We have found that this form of evaluation links much more directly to the learning processes of the participants then traditional forms of evaluation. Instead of comments on how the participants have perceived the program we get their own reflections of their own learning. This means that they focus on their own learning. If participants are asked to evaluate a course or a program they are asked to change the focus from their own learning process to the course-development process.

From their reflective comments we learn about what they have learnt - and about what they have not learnt (or at least not mention in their X-models). We can see how different messages have been interpreted by the participants, and in some cases also applied in the customer cases. When trying to improve the program, this kind of comments have proved to be very useful. One example is when people made comments about "blurred expectations" we then tried to improve and clarify the information given to the participants before the program starts. The rich picture built from all comments about the learning experiences of the participants, helps us to identify what parts of the program the participants really have learnt and used - and vice versa.

The discussion at the concluding meeting is a very useful supplement to the written reflections. Here, we can follow a discussion where the participants (and the executives involved in the program) discuss the entire program. The discussion is not in terms of evaluate the program, but to focus on what different people have learnt, how the gained knowledge can be applied in the future, how and to what extent the process has been useful for the customer case and for the personal learning.

Results of the Evaluation

The interview survey of the participants confirmed our picture about the usefulness of this form of evaluation. The participants usually had no changes in their opinions about the program. They regarded this final reflection assignment, when using the X-model for their participation, as useful for themselves. Some participants mentioned that they had spent a considerable amount of time on the reflection assignment, as they had found it interesting to thoroughly walk through the whole program and think about everything that had happened during the program.

In general, the opinions about the program were consistent over time, i.e. there were very few differences between the opinions at the end of the program and those two months later. There was one exception though, where there was a shift in opinion between the end of the program and the interviews. At the end of the program there were some comments about the need to reduce the number of reflection instruments during the program. Some participants expressed that it was too many reflection instruments to fill out at every meeting. After about two months when the interviews were conducted, some of these comments had changed. One person expressed this like the following:

> *"Well, I remember that I complained about the number of reflection instruments, but now when I look back at the process I realize the usefulness of them. I must say that after all I think you should stick to the number of reflection instruments next year, but be aware that they will complain too!"*

This comment could be seen as an example of how the usefulness of reflection sometimes is not seen immediately. In the next section, this example and other aspects of the findings will be discussed.

DISCUSSION

After having used this form of course evaluation, our general impression is that both the participants and we as instructors have gained from it. This evaluation is an important part of the learning processes of the participants, as well as important input for us as instructors when redesigning the program.

The evaluation used for the program is in line with the program in at least two different ways: we use a framework which the participants are familiar with (the X-model), and we use an individual reflection assignment as our evaluation of the program, which is in line with the reflection instruments used throughout the program.

In our opinion, there are two main objectives for this type of course evaluation where the focus is on the learning processes of the participants. The first one is to link the evaluation closer to the learning processes of the participants. The second objective is to separate the learning processes of the participants from those of the instructors.

There are several risks with traditional forms of course evaluation when participants fill out forms with different types of questions about the course. There is the risk of confusing the learning processes of the participants with the ones of the instructors. Asking the participants to give feedback on the course while they are in their own learning process, is to ask for something difficult. The risk is that the feedback neither is useful for the instructors when improving the course, nor facilitate the participants' learning.

The participants are, of course, very important sources of information when trying to improve a course. One challenge for instructors is to find ways to receive this feedback with as good quality as possible, i.e. to get feedback which is useful in the work to redesign a course. We have found that the approach "evaluation as learning" results in useful feedback for us as instructors and at the same time the evaluation is useful for the participants as it helps them reflect on their own learning. This is a help that might be important in accordance with the discussion by Senge (1990) about the difficulties for managers to take the time for reflection. Here they are "forced" to reflect on their participation of the program and often the participants find it useful, at least afterwards, as the example from the interview above illustrates.

One key factor is, in our opinion, that we have put the focus on the participants' learning. Ironically, we have found that by doing so, we learn more as instructors as well!

The description shows that we have found this form of course evaluation very useful. What are the drawbacks?

This qualitative course evaluation may cause problems for those looking for measures which are quantitative and possible to easily compare between different courses and different years. If one looks for that kind of measures it is important to ask the question: what is the rationale of this need? We have focussed on the learning of the participants as the most important, and as a second important component how we as instructors can learn and improve the program.

Is this form of evaluation possible to use in other courses? My spontaneous answer is simply: yes. There are some special preconditions for our use though, which means that the evaluation still has to be tried out in a different context. In our program the participants are familiar with the framework (the X-model) from their work during the program. If this particular framework would be used in another context there is a need for a short introduction to it. As the model is fairly simple and intuitive, this should be possible to do if even the course dealt with something totally different than change processes. This could mean 1-2 pages of instructions and a short presentation of the model when the "reflection assignment" is introduced. In some senses all courses deal with the same thing: to help participants to gain new knowledge during a certain period of time - to learn.

The evaluation described here could, of course, be improved. One idea is to stretch it over time. For example, the participants could be given a reflection assignment during the program, and maybe also a number of months after the program has finished. This could help stretching the learning process over a longer period of time.

CONCLUDING REMARKS AND SOME LESSONS

In this paper on evaluation as learning, one purpose has been to illustrate a form of course evaluation which we have used, and found being helpful both for the participants of the program, as well as for us as instructors. One key element is that the evaluation rather is a form for the participants to reflect on their own learning during the program, than an evaluation of a course. When the participants apply the framework (the X-model described above), this means that the focus is entirely on their own learning processes. They perceive the course evaluation, or rather their reflection assignment, as useful for their own learning. As a nice side-effect, it is most useful as a means for improving the future programs.

From the use of this evaluation, where we have tried to link evaluation closely to learning, there are several lessons to be drawn. Below some tentative conclusions are presented:

Lesson 1: *Make a clear distinction between the learning processes of the instructors and the ones of the participants.*

One purpose of course evaluation is to receive feedback in order to improve the course. This means that the focus is on the learning process of the instructors. When participants are asked to give feedback on the course while they are in the middle of their own learning process is to ask them for something difficult. We have found that we as instructors learn more by focussing on the learning processes of the participants. The input from the participants is, in our opinion, of high quality when the participants who spend time and efforts doing the evaluation (or reflection assignment) perceive it as useful in their own learning process - they gain something from it themselves.

Lesson 2: *Put the responsibility for the evaluation of the learning process with the individual.*

Evaluation of the learning process is something personal which by definition must be carried out by the person herself. By giving the responsibility to the course participants, without any detailed guidelines as specific questions, they have to reflect on their own learning process and involve themselves in the process. They have to involve themselves more than what is necessary when answering some questions on a graded scale.

Lesson 3: *Design the evaluation process in concert with the course contents.*

In this case we have used a framework included in the program and let the participants apply it to their own learning processes. When applying something from the course contents in the evaluation process, the learning can be improved and the risk of mixing the learning processes of the participants and of the instructors is reduced, and at the same time it is an example of "walk the talk". The possibilities for doing this varies of course between different courses. If there are no natural links to reflection and evaluation from any framework used in the course, a general model (like the model we have used) could be applied. The difference is that there is a need for a short introduction to the model before the reflection assignment.

Lesson 4: *Clarify the underlying purposes of the evaluation.*

An important question to ask is: for whom is the evaluation done? Is it primarily for the instructors? For the participants? For both? For future participants? For someone else? Traditionally, course evaluations often are for the instructors to improve the course, which in turn future participants will gain from. In our example, the evaluation is done both for the participants and for the instructors (in that order). We wanted to help them to further their learning, and at the same time we could learn in order to improve the program. When designing a course evaluation suitable for the situation it is crucial to clarify the underlying purposes: for whom and why are we doing this?

Lesson 5: *Use the evaluation for reflection to improve learning.*

We have designed this evaluation as a "reflection assignment". Instead of just asking the participants to fill out an evaluation, we have used the evaluation as a tool for their reflection in order to improve their own learning. By reframing "evaluation" the time and efforts spent on it could be changed, and by this also the usefulness of it.

In this paper, an example of a course evaluation has been presented and some experiences from this. There are obviously much more to be done in this area. This is simply an example of some steps in a direction where evaluation is more closely linked to learning processes - evaluation as learning.

ENDNOTE

The evaluation of this course evaluation was conducted as a teaching project within the International Teachers Program (ITP) 1996/97 at London Business School (see Robertson and Morrison,1996).

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HYPER-LINK TEACHING TO FOSTER ACTIVE LEARNING

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Active learning opportunities is an important element of course design. It has, however, not been integrated in the conduct of class lectures as they have evolved from early, chalkboard-based discussions to newer, multimedia presentation styles. The sophisticated, multimedia presentation styles have forced some rigidity, and have often, unintentionally, relegated the student to a more passive role in the classroom. This paper proposes an alternate mode of lecture delivery – Hyper-Link Teaching. It involves conducting the classes as anchored and guided discussion sessions. Executing this mode of teaching requires preparing class handouts as anchors for discussions and sharing control over class conduct with the students. The approach was first implemented during Fall 1995 for an undergraduate course in Systems Analysis at an accredited, large university. Student feedback indicates that the approach encourages students to engage in a more active role in the classroom, promotes higher levels of learning, and augments instructor responsiveness to student concerns. The approach is now an integral part of this instructor's class designs in multiple graduate and undergraduate courses.

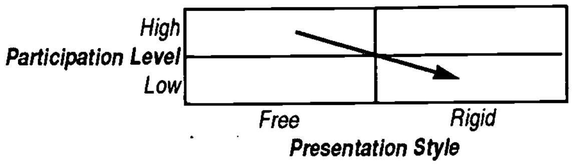
INTRODUCTION

Active learning has been a major theme in course designs over the years [2,7,8]. Techniques including hands-on assignments, team-projects, class presentations, industry-alliances and research-participation have been implemented for this purpose with considerable success. This philosophy of requiring an active role from the student (outside the classroom), however, does not appear to have filtered to the conduct of class lectures (inside the classroom), which have evolved [10], from early chalkboard style talks to overhead projector slides to the more recent phenomenon of direct-from-the-PC multimedia presentations using software packages such as HarvardGraphics™, PowerPoint™ and Freelance™. With the promise of reuse (and the time it affords for other creative pursuits), many instructors have elected the strategy of investing considerable effort in creating such class presentations. This has promoted consistency and coverage, but has required a great deal of effort for creating polished multimedia content such as sound, animation and video clips. With easy access to such presentation techniques and the widespread availability of PCs in university classrooms [6], the class sessions are slowly but unmistakably beginning to assume a high-tech presentation mode [1,11,13].

We contend that that an unintended consequence of this trend has been the relegation of the student to a more passive role in the classroom (see figure 1). While the use of multimedia facilitated by these presentation modes has captivated the student, it has reduced student participation in class lectures. Multimedia presentations have often forced a rigid mode of lecture delivery on the instructor and, perhaps sensing the instructor's reluctance to deviate from the technology-enforced game plan, has discouraged the student from active participation in class conduct.

FIGURE 1

CHANGING ROLE OF STUDENTS IN THE CLASSROOM



This paper argues that a class lecture is not the same as a presentation and should not be treated as such. It proposes an alternate mode of lecture delivery – Hyper-Link Teaching – that represents a conscious effort to step back from sophisticated presentation modes to recapture the teaching orientation of class lectures. While utilizing some of the benefits afforded by presentation software packages, it attempts to preserve the freeform lecture mode by designing and conducting class sessions as 'discussions anchored to and assisted by slide handouts.' The next section presents an outline of the proposed approach. It explains operation of the lecture mode and highlights pedagogical benefits anticipated. Section 3 describes implementation of the approach in an undergraduate systems analysis class, along with practices used for evaluation of the impact and reports the results. Section 5 presents a discussion of results and future directions.

HYPER-LINK TEACHING

In principle, hyper-link teaching represents a conscious effort to step back from high-tech, multimedia presentation styles to recapture the 'teaching' orientation of class lectures. It involves conducting class lectures as discussions anchored to class handouts and sharing control over the conduct of class sessions with the students. This section explains fundamental aspects in hyper-link teaching by juxtaposing them against comparable aspects of multimedia presentations, discusses practices required to successfully execute hyper-link teaching and highlights its pedagogical benefits.

Generally, the elemental building block of class lectures today is a 'slide,' prepared with a

FIGURE 2

MULTIMEDIA 'PRESENTATIONS' VS. HYPER-LINK 'TEACHING'

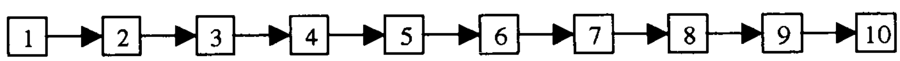


Figure 2 (a) Multimedia Presentation

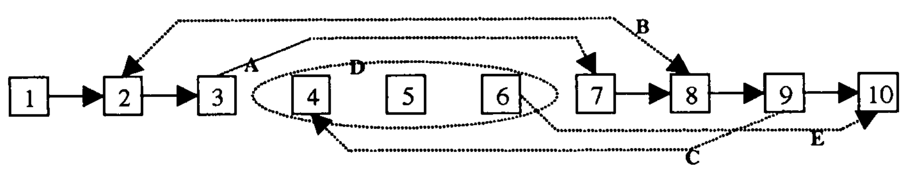


Figure 2 (b) Hyper-Link Teaching

An Example of Hyper-Link Teaching

The class begins with the instructor discussing concepts on slides 1 through 3. At this point, a question comes up regarding possibilities of using a construct introduced on slide 3. The class decides to jump (A) to slide 7 that shows an example of such use. The discussion is continued with more examples that appear on slides 8 and 9. While discussing slide 8, a reference (B) is made to a construct discussed on slide 2. After discussing slides 8 and 9, the instructor reverts (C) to slide 4 and the discussion proceeds again. The instructor now asks (D) the students to read together concepts presented on slides 4 through 6 and answers questions. The jump (E) to slide 10 wraps up the session.

software package such as Microsoft Powerpoint™ or Wordperfect Presentations™ or Framemaker™. These form the basis of class presentations and are often augmented with multimedia content. Often, the presentation is conducted by directly projecting the slides (with the multimedia content) from a workstation or personal computer. With this presentation mode, a typical class session proceeds in a predetermined fashion, with each slide building on material presented on earlier slides (see figure 2(a)). Slides are presented in a logical manner, often with additional information contributed by the instructor. The flow of slides, however, is strictly linear. Few deviations, if any, are encouraged or even permitted by the instructor. Hyper-link teaching, on the other hand, facilitates and encourages a dynamic path through the lecture materials (see figure 2(b)). The discussion flows typically, in a non-linear fashion. Deviations are encouraged and control is shared between the instructor and the students. Figure 2(b) schematically represents the conduct of a typical class session using hyper-link teaching.

Executing Hyper-Link Teaching

Executing hyper-link teaching requires viewing individual slides as anchors for class discussions, rather than one in an ordered set for structured presentations. This demands preparation of each slide as a relatively independent unit. Each slide contains important concepts and examples with related questions. For IS courses requiring a technical orientation (e.g. database management systems), the slides also contain definitions, problems and specific technical details. Though many of these elements are part of conventional class slides, hyper-link teaching allows formal and comprehensive inclusion of these. The slides are numbered and are delivered to the students in N-up (3-up or 6-up) format prior to the lecture (say, over the world-wide-web). The students are encouraged to (i) go over the slides, and (ii) attempt the questions from the slides – prior to the class session. The questions are placed strategically on the handout to serve as decision points for possible alternate hyper-links.

These handouts form the basis for class discussion. The class session proceeds as a 'discussion of slides' from the handout. No presentation software or overhead projector is used. Since the instructor and the students have the same class handout, with numbered pages and slides, reference to specific parts of the handout is easy. The session is conducted by the instructor and the students in an informal manner. The discussion often pivots around decision points provided in the slides. In response to concerns raised by students, the instructor sometimes decides to 'jump' to a slide out of sequence, in effect, forming hyper-links through the slides. This also involves choice – among multiple paths pointed to by student concerns – for the instructor. Often, class discussions evolve to integrate concepts, examples and ideas from multiple slides. The format also allows varying the amount of time devoted to one or more slides compared to others. Since the students are aware of the agenda for the class session – discussing the materials available on the handouts – they share responsibility (with the instructor) for managing the time spent on different parts of the handout. The discussion very often involves backtracking to a previously visited slide when students begin to make connections among concepts discussed on different slides. On occasion, the instructor also suggests that students simply read some slides allowing them a few moments of quiet reflection on difficult material. The 'big picture' – the topic for the day – often acts as the guiding principle in case conflicts arise during the class session.

Pedagogical Benefits

On reflection and after encountering reports from other educators who have grappled with similar issues [7,9], hyper-link teaching appears to reflect some aspects of Piaget's [5] model of the learning process. Piaget views knowledge as a mental framework that allows an individual to manipulate objects or ideas. Learning is the active process of modifying one's mental framework to incorporate a broader range of life experiences. Carried out in small, discrete steps, it is triggered when the individual encounters an unfamiliar idea that does not easily fit into her/his mental framework. The cognitive conflict that ensues is resolved only by a modification of the mental framework One of the prerequisites to successful resolution is the opportunity provided to the learner to manipulate the material. This involves quantizing the material in small chunks to avoid overload situations. In hyper-link teaching, the slides are designed to be independent units designed to illustrate a single new concept. Presenting multiple chunks simultaneously also suggests a pattern or a framework in the new material that the students discover as they proceed through the slides. The ability to view multiple slides simultaneously and backtrack as required also provides the students opportunities to synthesize [4] the concepts across slides in a framework that is uniquely their own. The instructor becomes more conscious of the students' need to create their own frameworks and responds, as needed, to help the students in the learning process. Specific pedagogical benefits from hyper-link teaching, therefore, can be summarized as shown in table 1 below.

TABLE 1

PEDAGOGICAL BENEFITS OF HYPER-LINK TEACHING

Promotes Active Learning	By handingover to the student partial control of and responsibility for conduct of class discussions, the proposed approach requires and elicits active participation from students.
Provides Opportunities for Synthesis.	By allowing the students to direct the flow of discussion, the proposed approach provides the students opportunities to form links among concepts from various slides.
Augments Instructor Responsiveness	By releasing the instructor from the burden of a rigid plan, the proposed approach provides flexibility to the instructor to quickly respond to students' questions and concerns.

IMPLEMENTATION AND EVALUATION

The hyper-link teaching approach was first implemented for an undergraduate course in systems analysis in Fall 1995. The changes mostly involved (i) incorporating additional materials in existing slides with a view to making each slide stand on its own, and (ii) integrating decision points on some slides to promote student interaction and serve as possible jump-off points to other slides.

Implementation

The handouts were made available in the form of Adobe Acrobat™ files via the world-wide web. Typically, the students were required to obtain slide handouts 1-2 weeks ahead of time (instead of at the beginning of the term) to maintain a sense of continual, active interaction. During the first few weeks, students were repeatedly encouraged to (a) read the handouts ahead of time and (b) answer questions on the slides – before the class meeting. As the term progressed, the students appeared comfortable with this routine. Many 'planned' to spend time on the handouts before class and some requested class handouts early to fit their schedules.

Early in the term, class sessions proceeded in a relatively linear fashion with the students content to follow the sequence of slides on the handouts. Fearing an impression of unplanned class discussions, neither did the instructor initiate any hyper-links through the slides. As students became aware of the freedom afforded to them and overcame some of the inhibitions, the class sessions turned more lively and required tracing nonlinear paths through the class handouts, coupled with extensive use of the whiteboard to further illustrate or explain points raised by students. Other than a few sessions that involved software demonstrations and hands-on use of the software, this pattern continued through the rest of the term. The implementation was an apparent success and students openly complimented the instructor for adopting this lecture format.

Evaluation

Evaluating the success of hyper-link teaching was a difficult task. As the term progressed, it was abundantly clear that success with this format was the product of a complex interaction among three sets of variables: characteristics of the instructor, those of the students, and the nature of the course material itself. Exact measurement was almost impossible considering the non-controlled environment. To provide an indication of success of hyper-link teaching, it was decided to employ two forms of measurement (similar to those followed in [3]).

The first was an in-class survey (see Appendix A) conducted at the end of the term. It was designed to gather students' impressions about hyper-link teaching. The questions were designed to reflect different aspects of the three pedagogical objectives (see table 1) as well as general impressions about the format. The survey employed a five-point Likert scale for the questions and also included a section where students could give additional comments. The second was a comparison of grades across two sections of the same class taught by the same instructor in two different terms – one incorporating hyper-link teaching and the other without. These would, of course, be subject to the caveats mentioned in [3], such as the learning effect.

Results

Of the 25 students enrolled for the class, 20 were present on the day the survey was administered. No surveys needed discarding in spite of some apparent but minor inconsistencies in responses. Twenty usable surveys were available for analysis. Results from the survey are summarized in tables 2 and 3 below.

Clearly the student group represented was diverse and had been widely exposed to many other forms of lecture delivery. Also, since all the students were reasonably advanced in their education (Junior year or above), they presumably had the maturity to accept and exploit a given mode of lecture delivery. In view of this, the following survey results are particularly encouraging.

The results clearly indicate that hyper-link teaching found favor with the students. The approach was liked in general, and apparently contributed well to the three pedagogical benefits outlined earlier. It was particularly satisfying to see that some of the impressions that the instructor formed during the term were validated by student responses. Questions measuring different aspects of the first objective averaged 2.12 or less (on a scale of 1-5, where 1 indicated the best score). The comparable averages for objectives 2 and 3 were 2.06 and 2.11 respectively.

TABLE 2

STUDENT CHARACTERISTICS

<u>Demographics</u>	
Average Age	23.89
Gender	
Male	50%
Female	50%
Year in School	
Junior	6
Senior	11
Graduate	1
Unknown	2

<u>Exposure to Different Lecture Modes</u>	
Online slides on world-wide-web	65%
Multimedia Presentations	70%
Overhead Projector Presentation	100%
Chalkboard or other Write-On	100%
Open Class Discussion	100%
Number of Students Enrolled	25
Number of Survey Respondents	20

TABLE 3

SURVEY RESULTS

Scale: Best | 1 | 2 | 3 | 4 | 5 | Worst

Objective 1: Promote Active Learning

	Mean	StdDev
5. Provided chances to contribute to discussion.	1.95	0.62
9. Felt I could ask questions easily.	2.05	1.03
13. Allowed backtracking when required.	1.90	1.02

Objective 2: Provide Opportunities for Synthesis

	Mean	StdDev
3. Was easier to see where we were and where headed.	1.65	0.67
6. Gave opportunities to digest material at different speeds.	1.55	0.60
8. Provided opportunities to see the big picture.	2.00	0.97
10. Created links across material from different slides.	1.95	0.71

Objective 3: Augment Instructor Responsiveness

	Mean	StdDev
4. Lead to interesting and lively discussions.	2.15	0.88
12. Allowed flexibility in time spent on each slide.	2.25	1.12
14. Allowed instructor opportunity to respond to questions.	2.00	1.03

General Impressions

	Mean	StdDev
1. Gave an impression of unplanned discussion of ideas*.	1.33	1.41
2. Difficult to coordinate slides with the instructor*.	0.70	0.66
7. Was boring since it did not involve PC presentations*.	0.79	0.85
11. Did not give picture of the overall topic*.	0.65	0.67
15. I liked this format.	1.90	1.02

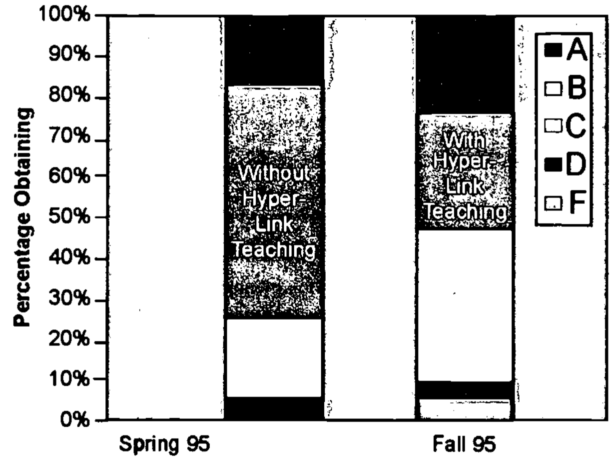
* adjusted for reverse scored questions.

Numbers refer to question numbers on the survey (see Appendix A).

Grade distributions for Spring and Fall 1995 are plotted in figure 3 below. The change in grade distribution (from Spring 95 to Fall 95) clearly indicates migration of students away from the large B-grade to either the higher A-grade or to a lower C-D-F-grade. The movement suggests that this mode of teaching may serve to differentiate students more clearly.

FIGURE 3

COMPARATIVE GRADES



DISCUSSION

Hyper-link teaching clearly found favor with the students. The changes in instructor-student interaction were amply evident to the instructor as the term progressed. The survey conducted at the end of the term confirmed the results. Impressions about the teaching format were surprisingly uniform. The format facilitated active learning (pedagogical objective 1) by sharing control for the conduct of class sessions with the student. It provided students ample opportunities for synthesis (pedagogical objective 2) by allowing non-linear and dynamic paths to evolve during class sessions. Finally, it augmented instructor responsiveness to student concerns (pedagogical objective 3) by permitting backtracking, skipping and bundling of slides. The statistics must be interpreted with caution since they are (i) based on a small sample (20 students), and (ii) do not span multiple instructors or courses.

Some speculations can, however, be made from the above statistics presented above and anecdotal evidence over observed over the last year and a half. First, it appears that some aspects of technology in classroom presentations may actually be harmful to the learning process. The rigidity introduced by presentation software packages may inhibit student participation. Hyper-link teaching allows a mode of instructor-

Hyper-link teaching allows a mode of instructor-student communication that naturally evolves to informal interactions, which leads to surfacing of student concerns. It also results in a more 'personal' approach to teaching that students appear to like. Student evaluations also indicate this fact. For instance, the statements 'Cares about the quality of his/her teaching' and 'Has a genuine interest in students' resulted in a rating of 5.0 (on a 5 point scale). Placed against an average of 4.0, this appears to indicate the success of hyper-link teaching in *reaching* the students at a personal level.

The approach is now an integral part of the author's teaching style for multiple courses, both graduate and undergraduate. It has been in use for almost two years. The results have been extremely encouraging, as evidenced by a jump in the instructor effectiveness rating from 3.3 to 4.8 (on a 5 point scale) for one of the classes, over a span of two terms. The approach has also been adopted my other instructors at the author's home institution.

Finally, one entirely unexpected benefit of the approach that is being realized by the author is the ability to reuse individual slides from presentations in new contexts. Since the slides are designed to be independent units (instead of part of an ordered presentation) it is relatively easier to create new class presentations for different target audiences - by *assembling* slides from multiple presentations.

CONCLUSIONS

Hyper-link teaching represents a conscious effort to step back from high-tech presentation modes to recapture the teaching orientation of class sessions. We have shown that it contributes to active learning. The approach has been implemented in multiple IS courses, both graduate and undergraduate, over the last year and a half with considerable success.

After stepping away from multimedia tools for teaching for reasons described in this paper, the approach - hyper-link teaching - was, in fact, implemented using a software tool that allows students to engage in a hyper-linked, exploration mode of learning through the lecture materials. A related paper [Purao 1997] discusses this implementation and reports some additional findings.

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APPENDIX A

This questionnaire solicits your feedback regarding the Teaching Format used in class - that is, the practice followed by the Instructor, of discussing/focusing on Slides from the Class Notes in a 'different' sequence, or discussing multiple slides simultaneously, or backtracking, or skipping, or spending more time on some slides than others, or asking you to simply read some slides.

Please tell me about yourself (anonymous):

Age: ______ Year in School: ❑ Freshman ❑ Sophomore ❑ Junior ❑ Senior ❑ Graduate

Gender: ❑ F ❑ M WorkStatus: ❑ Full Time Student ❑ Working Part Time ❑ Working Full Time

Please tell me about Presentation Formats in other courses you have taken:

How many courses have you taken so far at GSU (or other universities)? ______

Which of the following Presentation Modes have you experienced?

• Viewing OnLine Slides on the WorldWideWeb	Y	N
• MultiMedia (Audio and Video) Presentations	Y	N
• PowerPoint Slides or other (direct from the PC) Presentations	Y	N
• Trasparencies on Overhead Projectors	Y	N
• ChalkBoard or other Write-On Presentation	Y	N
• Open Class Discussion	Y	N

• Other: Please Specify: ____

Please tell me your impressions about theTeaching Format.

No	Statement	Agree				Disagree	No Opinion
1	It gave me an impression of unplanned and random discussion of ideas.	1	2	3	4	5	0
2	It gave me an impression of unplanned and random discussion of ideas.	1	2	3	4	5	0

Appendix A (continued)

No	Statement	Agree				Disagree	No Opinion
3	It was difficult to coordinate the specific slide I was looking at with the material the instructor was discussing.	1	2	3	4	5	0
4	It was easier to see where we were and where we were headed.	1	2	3	4	5	0
5	It was interesting because it was always a lively discussion.	1	2	3	4	5	0
6	It provided me with multiple chances to contribute to the class discussion.	1	2	3	4	5	0
7	It gave me the opportunity to digest material from different slides at different speeds.	1	2	3	4	5	0
8	It was boring since it did not involve any PC-based presentation.	1	2	3	4	5	0
9	It provided me opportunities to see the big picture.	1	2	3	4	5	0
10	I felt that I could ask questions more easily to clarify some points.	1	2	3	4	5	0
11	It helped me in creating links in my mind across material on different slides.	1	2	3	4	5	0
12	It did not give a clear picture of the overall topic being covered on that day.	1	2	3	4	5	0
13	It allowed flexibility in time spent on each slide before moving on.	1	2	3	4	5	0
14	It allowed me to clear up some questions by backtracking, if required.	1	2	3	4	5	0
15	It appeared to allow the instructor time and opportunity to respond to my questions.	1	2	3	4	5	0
16	I liked this teaching format.	1	2	3	4	5	0

17. Any suggestions for improving Hyper-Link Teaching?

____

____

18. What did you not like about Hyper-Link Teaching?

____

____

19. What did you like about Hyper-Link Teaching?

____

____

DESIGNING MULTIMEDIA FOR ECOLOGICAL TOURISM IN AN EDUCATIONAL SETTING

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This paper describes the development process of multimedia software designed to educate and provide awareness of ecotourism in Costa Rica. Ecotourism is a form of nature-based travel and recreational experience combining a respect for nature and local cultures with economic development incentives. The software intends to pursue the goals of ecotourism by presenting an alternative method of traveling: it provides a sustainable and entertaining alternative to direct visits. Additionally, it offers training prior to departure by presenting background reference readings, videos and "do's and don'ts" lists. Created during a Hypermedia Development course, the multimedia software, "Ecotourism on a Computer Screen: Ecotourism in Costa Rica," incorporates stills, graphics, videos and sound clips. The paper also details lessons experienced in the development of the software. Successful and unsuccessful techniques are described. Many of these procedures faced in the class project are repeatable, while several others should be avoided or implemented differently. In order to provide some useful hints for multimedia development both at the storyboard and programming levels, these alternatives are evaluated. Suggestions for facilitating a semester-long multimedia project are added. Future work includes developing a framework to test the effectiveness of multimedia software for ecotourism.

INTRODUCTION

This paper describes the development of a multimedia application in a graduate course on hypermedia information systems. It is primarily intended to illustrate the lessons learned from the exercise and evaluate the feasibility of undertaking such a project in a one-semester class. Fostering environmental protection by using interactive media technology is the second purpose of the authors and the developers of the CD-ROM. Further research will include hypothesis-testing on users' acceptance of multimedia as a sustainable alternative to travelling. The paper refers to the class project, which is offered as an example of the outcome of an introductory hands-on multimedia course. The content of the CD and the reasons for its creation are also analyzed by focusing on the benefits that environmentally-oriented technologies can bring to the conservation cause.

COURSE REQUIREMENTS AND ORGANIZATION

The CD "Ecotourism on a computer screen: Ecotourism in Costa Rica" was developed in a graduate course in the School of Business School and Public Management of the George Washington University. "Hypermedia Information Systems" is simultaneously a business and a multimedia development course. This dual nature of the course requires looking at the development of the application from two perspectives: the business component and the programming level. Both aspects have different implications and require different levels of expertise. In this specific case, the combination of students in the Master of Business Administration program with students in the Master of Information Systems program brought together the synergy of efforts to fulfill the course requirements and structure. This combination of students is successful as it adds marketing skills to a technical focus. In this way, software development assumes the features of a project management exercise: it needs to satisfy shifting requirements, to test the prototype, to develop marketing ideas and to create a product that is potentially ready for the market. The final grade is based on both the technical aspects (use of different media) as well as the originality, usefulness and commerciability of the idea.

The theory of multimedia, the learning effects of media integration, the basic notions of effective graphical user interface design are not within the scope of the course. This introductory course does not require a theoretical analysis and focuses exclusively on hands-on development, video digitization, capturing, scanning, sound recording and similar. It remains practical with a blending of the business and programming perspectives.

The Business Aspect

The business component of the course focuses on applications that have a financial value and serve a commercial purpose. The CD "must virtually sell," thus finding its niche in a non-saturated market. Students are divided into groups of four with the task of transforming a business idea into a software application. The teams are in charge of "selling their idea" to the class as if it was a business venture. This implies submitting a business plan with detailed figures on costs and scheduling (time and resources). This plan is presented to the instructor who critiques the economics of the proposed project and the feasibility of completion in the semester span. A work-breakdown schedule (WBS) of the project is submitted for review. The final WBS benefits from the input of individuals other than the development team. Classmates react to presentations of the storyboards and are given additional material to critique.

The process of critiquing other projects is particularly useful for furthering peer learning. At this stage, students are testing their ideas in public and they can determine whether the latter are likely to capture a share of the market (figuratively represented by class consent and support). Following the review, adjustments can be made to meet the business requirements. It is therefore important that the financial aspects of the project are detailed with consistency. Also the feedback from the targeted market segment needs to be taken into account. Depending on the segment, a certain amount of resistance to the use of technology needs to be factored in. Class reactions can be the first step for testing the likelihood of having found "the" idea.

Instructors may push for review even beyond the class context. In several cases, students contacted the interested organizations and presented their project both for acquiring extra-information and for discovering possible interest in using the software. Groups dealing with video-rentals contacted Blockbuster; groups developing a CD on US National Park contacted the Natural History Museum; groups developing an interactive map for Washington DC contacted the Smithsonian Institution, etc. The Costa Rica group contacted the Caribbean Conservation Corporation (CCC) and other interested environmental organizations. This requirement forces investigation about possible placements of the application.

The Programming Aspect

There are a series of constraints needing consideration when determining the application. The complexity of the project must comply with the resources available for a semester-long course in terms of equipment, access to laboratories and time allocated for the assignment. The choice is usually between development of a prototype by making only selected icons accessible, or development of a complete application. Time is the primary factor for consideration. Can the whole software be developed in one semester? The answer varies according to:

1. Number of people in the team and their areas of expertise;
2. Access to University resources (scanner, video capturing, software, camcorder, digital camera and other facilities);
3. Access to information to be uploaded in the software.

These factors are examined by drawing on the experience of the team involved in the development of the ecotourism CD. In terms of the number of participants, a group of four people worked smoothly. Having fewer people might create problems in the gathering of information, but provides the advantage of consistency in the integration of the various components.

The software used for this CD development is Version 6.0 of Icon Author by Amtech Corporation. In Icon Author, individual pages (called smart pages) perform similar to Web pages. As long as common patterns are established beforehand to reduce the complexity of the integration (authoring) phase, the smart-pages can easily be developed separately. This implies close coordination and parallel work by participants, a procedure that does not function well with a large number of team members. Regarding the level of expertise, it is desirable that different skills are represented in the team. Programming skills are as crucial as artistic, organizational and business skills. The CD needs to be attractive. It also needs to be structured. The user should become interested in the content as well as be at ease in scrolling around different pages without a manual of explanations. The means for understanding the objective and structure of the CD, without the developers' help are provided. Good organizational skills are crucial for an efficient technical development scheme.

In terms of access to resources, the number of users needs to be carefully controlled. Scheduling hours for access to laboratories by individual teams works better and avoids waiting time. Ideally, laboratory sessions should be made available for each team. Not surprisingly, there is also an issue of privacy that runs throughout the development. As in real business applications, there is no disclosure of the actual product until it is finalized.

In terms of access to information, before deciding whether to produce a prototype, it is crucial to have a clear idea on types of text, video and audio to use. If new material needs to be produced, the amount of time for the development of the final application increases exponentially. The final choice depends on how much material is already available, how many pictures need to be scanned or how many videos need to be filmed and digitized.

Prototyping versus Complete Stand-alone Applications

The choice between prototype and complete application was an easy one for the team members. There was information, pictures, videos and sound clips available from the developers' tour to Tortuguero, a national park in northeast Costa Rica founded primarily for the protection and conservation of marine turtles' nesting habitat. Additionally, access to University resources was available during weekend. These factors created a favorable environment for developing a complete application that would be "burned" into a CD at the end of the semester. Is this the desirable choice for any other course of this type? Unlikely. No other group in the course developed a CD ready application. Realistically, prototyping is a wiser choice for a one-semester course. In this particular case, the drive to convey a message for environmental protection warranted the extra-hours of work required for the development.

THE ENVIRONMENTAL FOCUS

The title of the CD is "Ecotourism on a Computer Screen: Ecotourism in Costa Rica". The second part of the title explains the geographical focus: Costa Rica. The first part conveys a new concept: practicing ecologically sound tourism using a computer. This is a step beyond the promotion of ecological tourism (ecotourism) as a form of travel to natural areas. Ecotourism is already an obvious success-story in Costa Rica. This country provides several opportunities for participating in nature-based tours. The tours vary from bird watching to volcano climbing, from turtle-watching to river and ocean kayaking. Tourism in Costa Rica is the largest money earner in foreign exchange. The geographical and ecological positions of the country capture different segments of the tourism market. Costa Rica is much more than a beach destination with elegant resorts. Nature-based tourism is increasingly gaining popularity (due to the saturation of the traditional tourist industry and to differing travelers' needs). The travelers of the nineties share new motivations (desire of escape, respect for the environment, etc.) that nature-travel seems to better address. Nature travel includes a subset of activities:

1. *Scientific Tourism*, which involves researchers, scientists and students that are performing their tasks or studies in the field;
2. *Adventure Travel Tourism*, which includes rock-climbing, horse-riding and kayaking and represents the fastest growing segment of the market;
3. *Natural History Tours*, which can be divided in "soft tours" (outdoor experience without a specific topic interest) and "hard tours" (interest specific travel for birds observation or similar);
4. *Ecotourism*, in which travelers learn about the interrelationships between living organisms and different natural areas.

Using the Costa Rica CD, the idea is to propose another category of tourism, a technology-based one that uses multimedia to reach segments of the market that are omitted by traditional and nature-based tourism. It appears that categories of people that are physically challenged and cannot join the adventurous activities mentioned are not considered.

The Costa Rica CD was not designed for commercial purposes. The main objective for choosing the ecotourism project is that of rendering a service to the environment. It is also an attempt to decrease environmental depletion by resorting to information technologies and attracting tourists to eco-oriented travels.

The Intended Audience

As explained above, the objective is to offer an alternative to traditional tourism by reaching specific users. The intended users are:

1. people who have an interest in promoting environmental protection (non-profit organizations);
2. traditional tourist-channels (like tourist operators) that can help develop this interest;
3. people with disabilities not able to visit these places; and
4. all those who have concerns, such as time and money, that prevent travel to these areas.

How to target these users? One way is the production and distribution of nature-based multimedia applications. CD-ROMs can offer a surrogate experience by designing a "virtual itinerary" for tourists desiring to visit ecological destinations. There are very few CDs of this type in the market. Most of the applications available are commercial and are beautifully designed to promote visits rather than replace them. The reason for this promotion is that while mass-tourism is a danger for the environment, it brings economic resources that are used for local development. And, ecotourism has an important economic component added to it.

The Economic Component of Ecotourism

Ideally, the best way to protect endangered-areas and species is to ask people not to go to there. Human presence, nolens volens, ends up disrupting the environment. This is an ideal concept that finds very little applicability in practice. As nature tourism provides economic resources for the environment, the prevailing interest is to attract visitors to natural areas using revenues for funding local conservation programs and fueling economic development.

Considering the economic facet of ecotourism and the benefits that it brings to developing economies, it is difficult to gather a consensus that information technology, and in this specific case multimedia applications, should constitute a substitute to travel. Anybody who had the opportunity, time and money would prefer to spend a week in Tortuguero observing the Snapple turtle laying eggs, rather than reading about it on a magazine or watching it on a video. Trying to promote the latter alternative - instead of - direct experience would be like fighting against the windmills. Not only is there opposition by those desiring to travel, but also by people living on income generated by tourism. In the short-run, economic benefits are usually stronger arguments than any concern of damages to the environment.

The Objectives of the developers of the Costa Rica CD

There are three main objectives pursued by the developers: the first one is to raise awareness about the environmental damage caused by tourism; the second is to solicit donations for conservation efforts; and the third is to provide alternatives means for travel for disables and children. The ideas presented in the Costa Rica CD do not imply that "virtual" is better than "real." They simply focus on some drawbacks of real experiences. Multimedia is here used as an instrument to **raise awareness** about the damage caused by interfering with turtles' nesting environments and practicing massive tourism in bio-diverse paradises. As an alternative to traditional tourism, the concept of ecotourism is explained and a training program for visiting Tortuguero is provided. Using the CD, users learn about the country in general, its economy, geography, political scenario and natural resources. Information on the Tortuguero reserve, environmental courses offered by the Caribbean Conservation Company (CCC) and videos on nesting turtles present scenery similar to the actual location. The training program helps the user gather information on behaving in eco-friendly locations (Do's and Don'ts are detailed). Examples of other eco-friendly locations (such as Manuel Antonio in Costa Rica and the eco-resort of Harmony in the Virgin Islands) complete the user's education about the meaning and the value of ecotourism. Additional information on lodging, shopping, eating and visa requirements are available to meet the needs of those eco-travelers that want to visit after having been instructed on ecologically sounds behaviors.

The reason for including information relating to traditional tourism is related to the second objective of the CD: to **raise donations** for promoting conservation efforts. Although the idea of lowering tourism might not be generally shared by tour operators, they want to be recognized as "friends of the environment". Tour operators may use the CD for training customers prior to departure, or even as an advertising tool. They may produce and sell the CD themselves, devoting a significant share of profits to the eco-location. Non-profit organizations working for environmental defense might sponsor the creation of similar CDs with reference to the Caribbean Conservation Corporation activities.

The last objective is to be comprehensive enough (still within the limit of a semester course) to provides opportunities for the disabled and children to **"virtually visit"** these locations. Sometimes this aspect is neglected by industry; multimedia may represent the only opportunity that physically challenged users have to learn about these remote destinations. Interactive multimedia, in its ability to combine text, sound, graphics and video can be the closest and a more complete substitute to direct visits. Associations for people with disabilities may be willing to sponsor the production of these types of CDs or at least to offer donations that support conservation efforts.

Because developing multimedia applications is increasingly expensive, it is important to focus on the monetary aspect of an eco-based multimedia application. In the class context, described later, most of the resources were available in the University and information could be accessed at no-additional cost. Should the idea of virtual travel to endangered areas be realized for commercial purposes (even if related to fund-raising for the environment), the production would require substantial investments.

THE DEVELOPMENT OF THE COSTA RICA CD

The Steps of Development of the CD

Creation of the storyboard and class review of the proposed project preceed implementation. Then, the actual designing begins. This entails creating a basic page with elements needing to be replicated consistently within the CD. In this case, the turtle-like navigation icons include the same colors for each topic and always change color when the link is selected. The different colors remind the user's location on the CD and enable movement to other pages.

After a standard initial format is established and common icons are copied to shared-files, the other pages can be developed separately. Team members collect pictures, graphics, digitized clips and sounds, and insert them into sub-menus. Each team member was in charge of an individual sub-project:

I. Costa Rica
II. Ecotourism
III. Flora and Fauna
IV. Eco-training Program
V. Travelers' information
VI. Eco-memories
VII. About the Caribbean Conservation Corporation (CCC)

The individual smart pages need to be integrated into a single authored program running the application and the loops. This task is performed jointly and changes to the structure of the pages are implemented simultaneously during the testing of the application. Finally, once the application is completed it needs to be burned onto a CD. These steps are presented in more details, each with a set of "success and failure stories."

Phase 1. Storyboard development by Team

The storyboard is one of the most critical stages of the development. It defines the structure and the content of the application. It needs to convey information on the topic, the format, and the scheduling of the project. Ideally it provides a pictured framework for the application. Using presentation software (MS PowerPoint 97, Corel Presentations) integrating sounds and videos is the easiest way to pre-view final software application.

Unsuccessful Technique. In the Costa Rica CD, however, the presentation software was not particularly representative. The CD is developed in several different pages that are connected by selectable buttons, hyperlinks for going back and forward from one page to another. A better way for presenting multimedia applications with these characteristics would be to use an HTML format to show movement as well as to include sound-clips. This task can be accomplished relatively easily, with Web publishing software currently available in the market.

Successful Technique. The choice of a topic with environmental focus gathered consent and support on the part of the class audience, witnessing the rising need for such an application and a possible agreement on the idea of exploring ways information technology can help the environment.

Phase 2. Creation of the First Page by Team (Figure 1)

The first page of the software is one requiring the user to input commands. It is preceded by a title page including sounds, pictures, animation, developers' names and leading automatically to the first interactive page. If animation in the title page is running, the user cannot interact or quit the program until the first page is reached. On this page, the user makes a choice on "where else to go." He needs to understand the structure very clearly. The first page becomes the access card and needs to be particularly self-explanatory, even more than the other pages.

Unsuccessful Technique. The interactive icons that lead to internal pages are not numbered. Ideally, the display is on a vertical line and the user will be prompted to start from the first element on the line. This is not necessarily the case, though. The user can decide to start following the topic that appeals him the most thus finding himself confused about the sequence of events. Numbered buttons would alleviate the confusion.

Successful Technique. The Costa Rica's first page includes a short speech explaining the purpose of the CD, the environmental concern for Costa Rica and the sea-marine turtles. On this page there are the selectable icons leading to the other sections of the CD. Additionally, each icon contains a pop-up menu which displays the different topics represented by the icon. By moving the mouse over any of the turtle-like buttons, the user understands the structure of the section and is prompted to select an icon representing a topic of interest.

Phase 3. Creation of pages by topic area by team members separately

This phase varies according to the choices made by individual developers.

Unsuccessful Technique. Most of the pages contain embedded pictures and photographs as background images. The picture is desktop-sized and, therefore, the .gif file is large. This creates a problem when displaying the application with different computers. With a fast pentium CPU, the delay in displaying the next page is minimal. This delay becomes larger when dealing with less sophisticated technology. A blank transition page appears for intervals that vary from 2-10 seconds, depending on the refresh time of the equipment used. A way for partially solving the problem is linking the graphic files to the smart pages. However, this option is not optimal, as linking requires that files be placed in the same location. In a class and laboratory context, it is very unlikely that the same computer is accessed every time. The files usually need to be copied onto zip-drives or uploaded to Unix accounts. The latter process can become increasingly complex if each file needs to be constantly placed in the same directory. Although it is not optimal, in terms of delay in the display, embedding is preferred solution when dealing with different directory structures and equipment.

Successful Technique. The pages were developed separately, thereby adding dynamism and variety to the software. The changing background colors, artistic structure, informative content and special effects of new displays capture the attention of the user.

After the completion of smart pages, the description of each topic page needs to be developed separately. The following overview offers a more detailed description of the software and its goals translated into interactive objects.

Topic I. Costa Rica (Figure 2)

This page is an introduction to the country, containing information about geography, climate, economy, socio-political system and natural resources. The information is displayed with text, a short video on Costa Rica and a sound clip on the national anthem. Except for the page on the geography that is linked to a full-sized screen map of the country, this sub-topic is developed on a single page. Text and pictures change on button clicks, maintaining the same spatial position in the page.

Unsuccessful Technique. This page contains video and graphics whose uploading causes an evident delay in the running of the software.

Successful Technique. This page provides a complete introduction to essential information on the country.

Topic II. Ecotourism (Figure 3)

This smart page contains an overview on the concept of ecotourism, its growth patterns, its goals, the tourist population targeted and examples of eco-spots in Costa Rica. The background page is static and the videos, text and pictures vary at the click of the buttons.

The pros and cons are similar to the considerations for the previous page.

FIGURE 1

FIRST PAGE

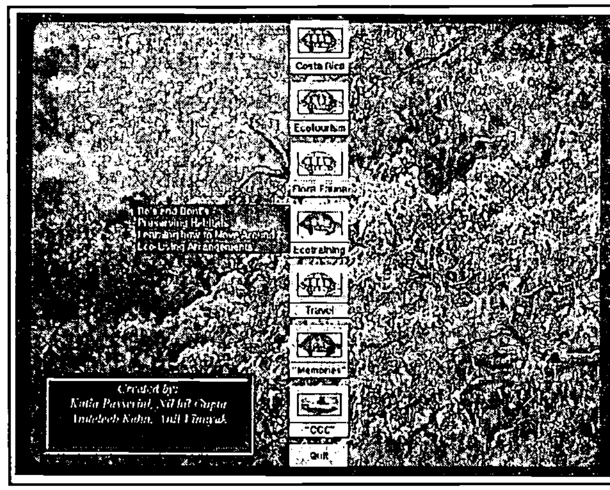
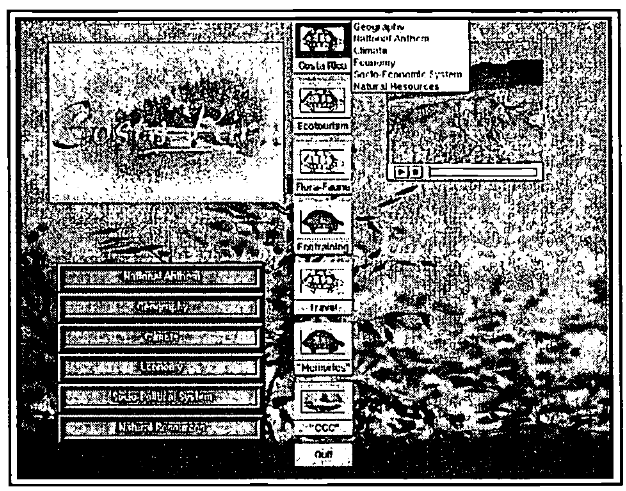


FIGURE 2

COSTA RICA



Topic III. Flora and Fauna (Figure 4)

This topic displays a graphical overview of the endangered species in Costa Rica. It contains a slide show of pictures and photos changing to the rhythm of superimposed music. A subset of pages with examples of endangered species, which includes sound clips, text, video and graphics, can be reached from this page.

Unsuccessful Technique. Moving from one category to the other (from mammals to insects, to birds, to amphibians, etc.) requires returning to the original page that displays the slide-show.

FIGURE 3

ECOTOURISM

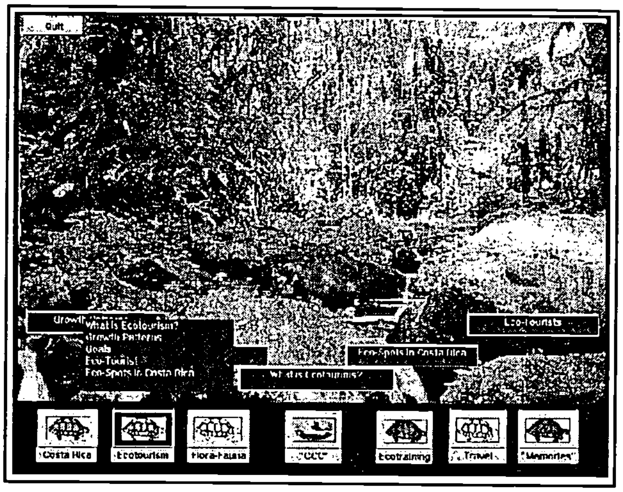
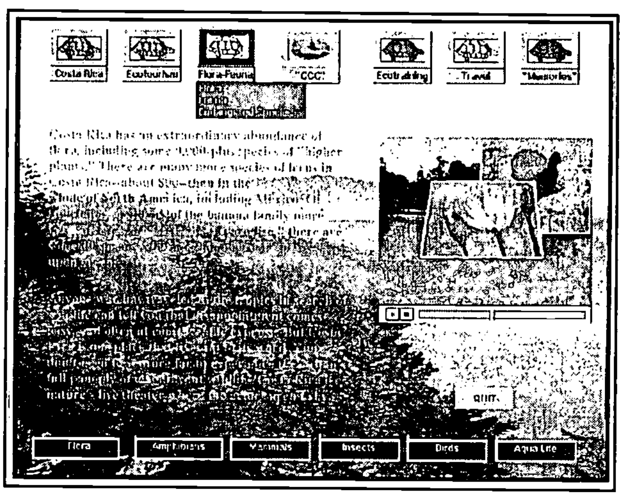


FIGURE 4

FLORA AND FAUNA



Successful Technique. This topic provides an excellent instrument for introducing users to the natural environment of Costa Rica. This fulfils one of the main objectives of ecotourism: favoring the exploration of the natural habitat by hearing sounds, watching the animals or flowers and "feeling there."

Topic IV. Ecotraining (Figure 5)

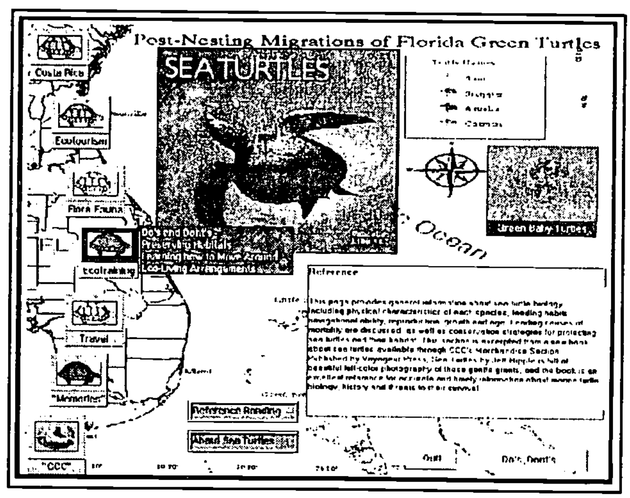
By suggesting reference reading and showing a video on turtles laying the eggs, this page introduces the topic of sea-marine turtles. It provides links to Do's and Don'ts that need to be followed by eco-travelers (prior to departure, during the trip and after returning home) and offers information about courses on sea-turtle nesting offered in Tortuguero. It also details what to expect when visiting Tortuguero and what to bring during the visit. Lastly, it offers examples of ecologically oriented resorts both in Costa Rica and in other Caribbean spots.

Unsuccessful Technique. This topic is developed in several different pages and the user is forced to scroll back through each of them to return to the original menu. A better structure should have allowed the user to move to other topics from each page.

Successful Technique. This is a complete overview that strictly mirrors the experience of turtle-watching. The clarity of the video and details is even more informative than what is able to be seen on the Tortuguero shore. The use of hotwords in the Do's and Don'ts section allows the developer to superimpose extra-graphics over the same background.

FIGURE 5

ECOTRAINING



Topic V. Travel (Figure 6)

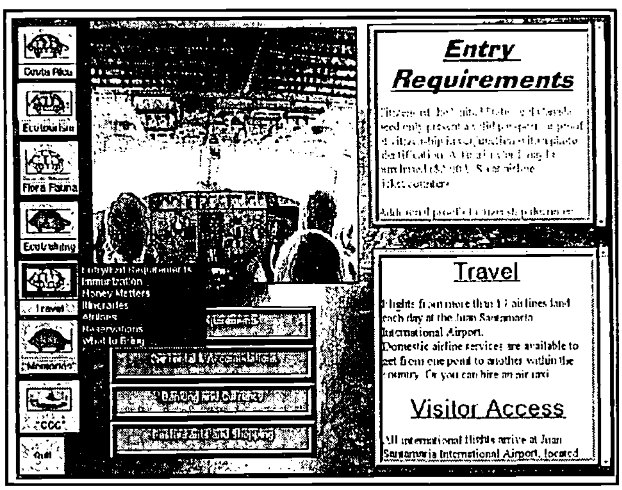
This section provides information about entry requirements, car rentals and accommodations, banking and currency, shopping and restaurants. This information is useful for tourists already deciding to travel.

Unsuccessful Technique. The use of fonts and colors is not appropriate. The selection of large fonts is more appropriate for presentations rather than on-screen reading.

Successful Technique. The amount of information and the use of blinking images add dynamism to the page.

FIGURE 6

TRAVEL



Topic VI. Eco-memories (Figure 7)

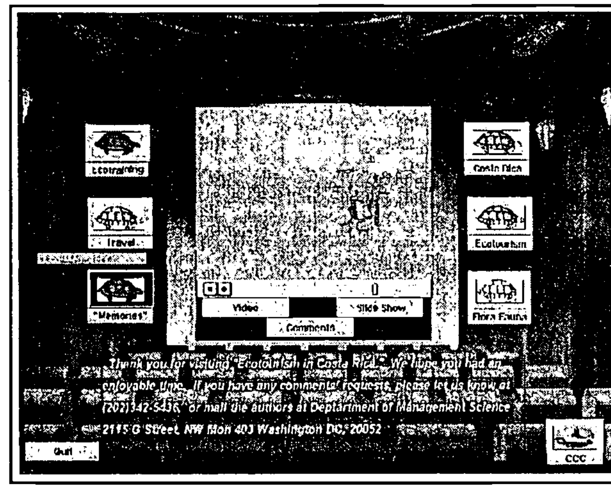
This page is a photo-album for the user, an ex-post experience with a collection of images of the adventurous trip. Since the developers of the CD are trying to reproduce "real travel" with "virtual format," the photo-show creates another successful simulation element. It produces settings similar to a movie theater.

Unsuccessful Technique. The photo-show file runs very fast without pausing to enjoy the beauty of the scenery, as it would be desirable in the real situation.

Successful Technique. The settings bring back memories and pictures that give the impression of having been there and being one's own set of memories.

FIGURE 7

ECO-MEMORIES



Topic VII. CCC (Figure 8)

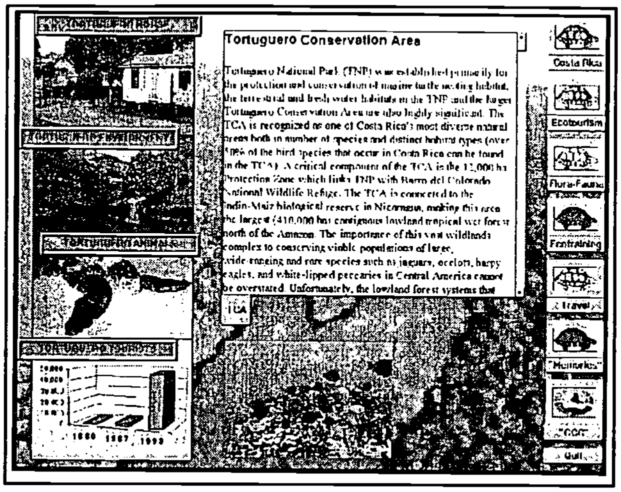
This is an introduction to the role of the Caribbean Conservation Corporation and its efforts on sea-turtle protection. The national park of Tortuguero and its environment is described, with additional information on ecological activities.

Unsuccessful Technique. This topic can be seen as the last or the first in the list, depending on how the users decide to scroll the software. A better approach would have been one of opening the CD with an overview of the CCC activities therefore focusing on the objectives of the CD.

Successful Technique. Assigning CCC its own separate place, independent to other topics gives a stand alone value to each topic and opens the possibility of using the CD for exploring different elements. If the user is not interested in sea-turtle protection, he can still use the software as a good representation of the beauty of a place interesting to visit.

FIGURE 8

CCC



Phase 4. Integration in a single program (authoring) by team

This phase is the stage in which completed smart pages are put together. Programming is needed to integrate the sections through the links established in the individual objects.

Unsuccessful Technique. Some objects in the smart pages needed to be eliminated, as the program could not run the animation. Earlier testing would have saved the time used for the development of the discarded animation.

Successful Technique. After integration, quality and content control can be completed. Redundant information was removed.

Phase 5. Testing and correction of final program by team

Testing was conducted on several computers around campus. Initially, testing was limited to computers available in the multimedia laboratory.

Unsuccessful Technique. In the testing stage, several bugs were revealed, starting with the inability to display the videos. Some computers did not interpret the same video conversion format used in the digitization. Prior testing on computers different from the ones used for development would have detected the problem earlier. Each video file needed to be re-saved in generic format, compatible with standard installations. The quality of the original videos was substantially reduced. In addition, it was revealed that font size and appearance varied with the computer resolution. The application was designed for 800 X 600 resolution and major changes in each page where required. As time did not allow for extensive changes, a note on the CD case warns users about optimal hardware requirements.

The important lesson learned is that development needs to be conducted in lower resolutions throughout the project or, at least, it needs to be carefully tested on different hardware platforms during the project. The same applies when files need to be embedded, as size affects the uploading time.

Successful Technique. This phase gives real understanding and feedback about successful techniques. It is crucial that testing is conducted throughout the development in other facilities than the regular multimedia laboratory.

Phase 6. CD-recording by team

After the software is tested, CD-recording (burning) can be the easiest step as well as the most complicated. Mistakes can definitely be made at this stage, particularly by incorrect copying of the directory structure. Realistically, few CDs are lost in the process. Unless a re-writable CD is used there is room for faults. It is crucial that all the files used in the development are copied onto the CD for it to run successfully.

Lessons Learned in the Process

To recapitulate the lessons learned in the development, it can be stressed that the most crucial need in multimedia creation is to test the application on different platforms. Testing with lower quality equipment becomes crucial. Testing needs to be undertaken during the development as well as at the end. Early testing allows solving problems as soon as they appear. It also indicates how feasible is to implement abstract ideas into a programming language. Often times, the best idea is not easily translated into code.

Another lesson is that multimedia development in the classroom is best carried on in teams assigned different tasks for gathering data and sound, video and graphic files. In order to integrate the project once the individual objects have been completed, these teams need to follow pre-agreed guidelines.

There are still a series of bugs that could not be fixed before the end of the semester. The main concern was producing a final product that could be stand-alone and that could be shown to multimedia developers and environmental experts not just as a finished application, but as a representation of an idea that can help the environment.

Multimedia can NOT be a substitute to direct experience. However, it can be a useful training program for tourists deciding to get in contact with the environment: they need to learn how they are expected to behave and what are the Do's and Don'ts of their ecological experience. Multimedia can definitely be close substitute to direct visits for those that are not able to practice ecotourism because of physical constraints. Taking all this into account, the virtual experience becomes desirable.

FURTHER RESEARCH

One interesting aspect of this application the writers intend to explore is the impact of this product on general users. Do their attitudes toward environmental protection change after being exposed to the program? Do they see the benefits of virtual- travelling? Would they change their itinerary on the basis of the message they received from the CD? Would they, at least, consider an adjustment to their travelling style to include attention to recycling and respect for the flora and fauna? If yes is the answer to one or two of the questions above, this is already a step in the right direction. These and similar questions will be posed to full-time MBA students taking information systems courses. An on-line survey will be administered to these students before and after the use of the CD. Results will be analyzed in a hypothesis-testing framework and will include statistical analysis of data.

There will be several factors and biases that will need to be taken into account in the evaluation (i.e. the sample surveyed is not random). Controlling for these factors and recognizing their effects will be crucial. However, if statistical significance is found, it is hoped that the analysis can constitute a step forward in creating professional applications that will be more environmentally oriented than traditional tourist applications. The greater benefits for the environment will ultimately benefit the whole population.

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AN INNOVATIVE APPROACH TO TEACHING DECISIONS SUPPORT SYSTEMS

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This paper describes the design, implementation, and subsequent redesign of an innovative MBA Decision Support Systems course. The curriculum is developed around a collaborative, technology-based approach that emphasizes teamwork and problem solving to teach students the principles and applications of decision support systems. Problems encountered during implementation, adjustments made, lessons learned, and recommendations for educators are included.

PURPOSE AND BACKGROUND

For the 1996-97 academic year, a new, innovative course in Decision Support Systems (DSS) for an MBA program was implemented. This course was designed to be able to adapt to the constantly changing Information Technology (IT) field. The course is required for students who are pursuing an Information Systems Management concentration and is an elective for all other MBA students. The original intent was to develop a course that would familiarize students with current DSS enabling them to make informed decisions/recommendations within their organizations while emphasizing the ever-evolving nature of the field.

Initially, the course was designed to be taught almost totally through collaboration and teamwork in order to augment the students' problem-solving and interpersonal communications skills which are among the skills that the business environment currently demands (Sriram & Coppage, 1992; Cougar, et al., 1995). Technology-based learning was incorporated to increase the group's decision confidence and satisfaction with both the decision and the group process (Pinsonneault & Kraemer, 1989). As the course was implemented and taught for two semesters, some significant changes were made. The course is currently at a point where it appears to be meeting the needs of the students and their organizations and its adaptive nature should enable it to continue to do so.

This paper will look at the original plans for the course and follow the implementation process and the evolution of the course. Successful and unsuccessful aspects of the course will be explored, and finally, lessons learned and recommendations for educators will be provided.

ORIGINAL COURSE DESCRIPTION

This section provides a general overview of the course and the theoretical foundations on which the course is based. Readers wishing additional detail are referred to Van Slyke and Kittner, 1996.

Course Goals

The original purpose of the course was to provide an overview of the general concepts of DSS and the related decision-making tools such as Executive Information Systems (EIS) and Group Decision Support Systems (GDSS). The goals were to:

- Teach DSS concepts, including their proper application to business problems.
- Improve students' interpersonal communications, teamwork, critical thinking and problem-solving skills.

Course Structure

The entire course was designed to progress the students through the field of DSS using a group-based, collaborative approach to teaching. All assignments and exams were performed collaboratively. It has been found that students are able to practice important interpersonal skills by collaborating on course assignments and collaboration also increases the communications opportunities afforded the students (Norman & Spoher, 1996). In addition to these advantages of collaborative learning, increased complexity of thinking, acceptance of different ideas, and motivation to learn are thought be outcomes of collaborative learning experiences. A sense of connection among the students is an additional benefit of this learning process (Gamson, 1994).

In addition to the theoretical advantages, employing collaboration serves an important pragmatic purpose--preparing students for what they will encounter in the new organizational environment. Not only are organizations moving to more collaboration in the workplace (Kearns, 1989), but it has been found to increase the satisfaction with the learning process (Pinsonneault & Kraemer, 1989). In order to provide additional collaborative learning experiences, a case utilizing groupware was required with team members at a university in Mexico.

Groupware. A groupware lab, which included GroupSystems from Ventana Corporation and Lotus Notes, was being planned at the same time the course was being developed. Because of the anticipated availability of these popular groupware packages and their importance in the DSS field, the course was designed to fully integrate them into most activities.

Class meeting organization. Each three-hour class was comprised of three parts: 1) a group research project presentation, 2) a case preparation and presentation, and 3) an instructor presentation on a DSS topic. Additionally, students were required to submit a weekly experience log that recorded their thoughts on their class experiences. (See class syllabus, Appendix A.)

Research projects. Two group research projects on DSS topics were required of each student. The purpose of assigning these projects was both to provide students with an opportunity to obtain an in-depth understanding of the particular topic and also to provide the class with timely material not available in the text. The DSS topics were instructor selected with students then choosing from among the available topics. For one of the projects, the students were to collaborate using face-to-face communication while the other was to be prepared through the use of Lotus Notes. The purpose of the two distinct processes for project development was to provide the student with hands-on use of Lotus Notes as well as illustrate the advantages and disadvantages of teamwork through collaborative software. The research of the topic by the groups was intended to have them actively engaged in the learning process rather than be passive listeners. As the students researched the material, they would understand that because of the ever-evolving nature of the topics, an important segment of the information had not yet reached the textbooks. The amount of time it takes to write and publish a book makes much of the essential information for the class outdated. Sources other than the textbook needed to be used. The practical experience in group dynamics, communications, and collaboration that was provided by these projects was very beneficial.

After a 30-minute presentation by the group, the instructor would round out the coverage of the topic adding material not covered in the project presentation the group submitted. An outline of the group presentation was submitted the preceding week to enable the instructor to prepare the lecture. These discussions were in the traditional lecture/discussion format, but GroupSystems was to be used to enhance student/instructor interaction.

Cases. Casework was a foundation of the class. By basing instruction on problem-solving activities as in case-based instruction, students are better able to experience the changes that come from learning new concepts. Case-based instruction also helps students improve their problem-solving skills (Bransford & Stein, 1993). The cases were designed to reinforce the various DSS topics. The students completed the cases in class after reading and thinking about the cases prior to class. All cases were completed by teams whose composition was dynamic--changing for each case. The team assignments were given at the beginning of the class period in order to eliminate prior preparation thus insuring teams equal preparation time. Teams were assigned to one of two modes of interaction--using GroupSystems or not using groupware support. During the semester, each student had several opportunities to experience both interaction modes. Teams were to present their case analysis using GroupSystems, with a team member acting as facilitator. This was to provide additional experience with the use of groupware, and the facilitator would gain experience and insight into the process of leading a group discussion using groupware. The casework would also provide an additional opportunity to engage in teamwork, whether groupware supported or not.

Experience logs. Students were required to maintain a log of their thoughts about their class-related experiences. The initial plan was for students to complete the experience logs using Notes. These logs were included to provide more hands-on experience with the technology and also to provide a valuable feedback mechanism (Edleson, et al., 1996). By monitoring the logs, the instructor gains insight into how well the class understands the course material. It also gives the students the opportunity to express concerns, ask questions and most importantly, reflect on their experiences. The logs provide the instructor with input that is useful in the continuous improvement process of refining the course.

IMPLEMENTATION PROCESS-- THE PROBLEMS BEGIN!

The implementation process was a long, arduous endeavor. Two days before classes were to begin, the room had no furniture, no hardware, and insufficient electrical power. The text which was ordered was not yet available nor were the various videos and software applications and demos that were to accompany the text and had been included in the curriculum. Time to quickly regroup!

A great deal of thought was given to canceling the course for the current term. This was discouraged by the MBA office because of problems with rescheduling the enrolled students. Because a holiday followed the first week of class, thus giving a two-week period to get everything in and installed, the decision was made to continue with the class. All enrolled students were called and the current situation explained. Each student was given the opportunity to drop the class with the knowledge that the problems could conceivably not be resolved for the entire term. Most felt that the process would be a great learning experience and would parallel many of the problems faced in a typical system conversion in the business environment. Each stated his/her willingness to be flexible as the course unfolded, and almost all expressed excitement about the innovative approach to the curriculum.

Facilities

The furniture had been special ordered about three months prior to the beginning of the term with delivery expected in time to complete installation by the start of the term. The tables were designed specifically for use in a groupware environment. For example, monitors were recessed in order to block the contents from other participants' view, thus preserving anonymity. After much interaction with the supplier, it was finally determined that the desks would not arrive until the middle of the semester. Eight-foot tables were moved into the room and arranged in a "U shape", and the 17 inch monitors were placed on the tables with little space between them. One of the intrinsic values of GroupSystems is the anonymity it provides. Not only did the large monitors on the tables eliminate the anonymity factor because the students could view each other's monitors, but they also completely blocked the view among the students and between the students and the instructor. This seclusion encouraged minimal class participation, students talking with their neighbors, and students using the computers when they should have been listening and contributing. The intended collaborative approach to the course was effectively eliminated until the new desks arrived.

System Problems

The computers arrived as the semester began, but the installation process for GroupSystems was fraught with problems. Even though the instructor received forty hours of training in GroupSystems which provided an understanding of the way the software worked, the training did little to prepare for installation or troubleshooting. GroupSystems is a client-server based package that is used simultaneously by a number of users and as such proved complex to install. Although the GroupSystems support people spent many hours working with us, we were unable to get the software to function. The network was operational, and there was sufficient memory and CPU speed. Hardware, software, and networking consultants were independently brought in--to no avail. The first major breakthrough came when it was discovered serendipitously that the network driver that came factory installed was a lower version than the driver version on the accompanying disk. When a more recent version of the driver was installed, it enabled the clients to communicate with the server while running GroupSystems. This was accomplished approximately one month after the term began.

The experience logs submitted by the students illustrated their frustrations. In spite of the warning before the term that the software might not be available the entire term, the students felt they were missing out on an important element of the course. They were told that most DSS classes didn't incorporate groupware, but they continued to be dissatisfied. Every class period included an explanation of what steps had been taken and a discussion of what possible courses of action could be pursued. This discussion provided a learning opportunity for the students and the instructor. When the correct network driver version was installed, GroupSystems was tested and appeared to be functioning. However, the first class activity using the package was a disaster. The response time was about a minute, and some of the machines appeared to lock up. This slow response time when the entire class was logged on was not apparent when GroupSystems was tested with three machines being used simultaneously. Now what?

GroupSystems support people verified that we had sufficient memory on the server and the workstations and that the installation appeared to have been done correctly. A patch for GroupSystems was downloaded from the Internet and installed but provided no obvious improvement. To this point, several hundred man hours had been spent working on this one lab.

Making do and finding solutions. Throughout this first half of the term, the material was covered by the traditional lecture/discussion method. Although the final versions of the videos and software that were to accompany the text were still not completed, the publisher provided the instructor with "in-progress" versions. The videos were helpful, but virtually none of the software was functioning. The Internet proved a welcomed source of demos and simple DSSs. Group projects and case studies were completed with face-to-face interaction with the hope that future projects and cases could incorporate groupware. The experience logs were completed but not using Lotus Notes as was originally intended. The students' experience logs showed continued dissatisfaction with the lack of groupware and isolated instances of discontent with the lack of participation by students during group discussions due to the visual obstruction of the large monitors.

The computer desks arrived about midterm although one arrived broken. A replacement was not available until after the term was finished. Removal of the visual obstructions brought about a complete transformation in the dynamics of the class. Class interaction immediately commenced. Each student contributed and a previously lacking synergy developed. It was amazing to observe the differences between one week and the next. It was as if it was a completely different group of participants.

The cause of the slow response time was finally identified about two months into the term. Virus scanners on both the server and the workstations appeared to be the culprits. When these were deactivated, GroupSystems finally worked! Although the problem was identified, it was not easily solved because viruses regularly crippled the labs when the scanners were disabled. The temporary solution was to deactivate the scanners before each DSS class and hope for the best.

Two of the biggest sources of student dissatisfaction with the course were now eliminated. The experience logs began to show positive feelings about the course, and the negative comments were far less significant.

More Problems--Lotus Notes

By this time, it was apparent that Lotus Notes would not be functional during this term. Not only was the package not yet installed, but also the learning curve for the instructor was found to be much steeper than anticipated. Four days of training had been completed, but that was not sufficient to do those activities originally planned. A great deal of up-front work would be required in order to accomplish them. Students were informed that this element of the course was to be eliminated. They were disappointed, but by this time, they were not surprised.

The initial semester ends. The end of the term thankfully arrived. The instructor evaluations reflected the frustrations of the students, although most indicated they had learned a great deal and the course was very valuable.

The disappointment of the students did not come close to matching the frustration, anger, concern, and stress experienced by the instructor! Any new course requires extensive preparation, and the instructor learns a great deal the first time through. However, a new course with new hardware, software, and furniture and all the associated problems makes for a challenging semester. Once the semester is completed, the important thing is what was learned by the instructor to make the next semester a more positive experience for all concerned.

CHANGES TO CURRICULUM

Although the goals of the course remained constant, experiences from the initial semester fostered changes to the course content and methods of delivery. The collaborative activities, while still considered an important component, were slightly de-emphasized. Both projects were still team based as a result of the meaningful contributions of this learning technique. While all the casework had been previously completed in teams, the updated requirements allowed for a choice on several of the cases between teamwork and individual work. This was in response to dissatisfaction with unequal participation from all team members. Although one component of the case grading process including team members dividing 100 points among the team members for participation, it didn't alleviate the frustration over some team members having to do the majority of the work. Although this was discussed as a relatively insignificant weakness in most team efforts with advantages outweighing this disadvantage, several students chose to work on the cases independently.

Experience logs were still required. Although they were not completed using Lotus Notes as originally planned for the first course, the input and responses provided by weekly logs was too valuable to eliminate.

GroupSystems was to play an important role in the second semester. With its previous emphasis as a support tool, its mastery would now become an end in itself. As industry is becoming more aware of group decision support tools, the ability to design, develop, and facilitate a session becomes more important.

Lotus Notes was installed between semesters. An exposure to some of its capabilities and uses were given in the second semester. Hands-on experience was minimal including only the mail function and personal tools. Although class time didn't permit in-depth coverage, students were particularly anxious to explore this group decision support software. The joint case study with the teams from Mexico, that was originally intended to be facilitated by Notes, was removed as a goal for the second semester and hopefully will be included in future courses.

Because students' experience logs and final class evaluations indicated that the students had the best understanding of those topics which had been assigned to them as their group projects, additional technology-based learning seemed appropriate. A component was added which had each student "surf the Net" to find information about each weekly topic in preparation for class discussions. This activity proved to be very well received and enhanced the topic discussions. Demos on various DSSs such as executive information systems, intelligent agents, and expert systems were found on the Internet and used to demonstrate the topics. Without these, each of the topics would have been much less meaningful. During this second semester, the software that accompanied the text arrived and included useful demos.

LESSONS LEARNED AND RECOMMENDATIONS

Through experience and a great deal of "trial and error", valuable insight was gained to enhance subsequent offerings of the course. The following suggestions are products of "lessons learned the hard way."

- Don't start a course until the technology and facilities are functional.

  Include slack time in the installation schedule to allow for delivery delays, non-functioning and damaged equipment, and other unforeseen problems.

- Test, test, test (The system, not the students' patience)

  Allow time and allocate manpower to test the system under class conditions. On several occasions, problems that were resolved when testing with two or three workstations reappeared under the load of the entire class.

- Be vary of publishers' promises

  Don't adopt a textbook based upon promises from publishers particularly when software is included and essential. Publishers experience many of the same difficulties that were encountered during this course implementation, and their problems become yours. If the book and accompanying materials are not completely finished, adopt something that is.

- Learn from the experience of others

  Seek those with similar environments. Although businesses that used GroupSystems were consulted, they did not experience the same set of problems as those associated with student labs. For example, the virus scanners were not recognized as a possible problem because the businesses did not use them.

- Have contingency plans

  Regardless of the amount of testing that has been done prior to class, problems WILL occur. The class experiences far fewer frustrations if a new activity is immediately begun with the problem to be solved in time for the next class.

- Keep experience logs

  The logs provide valuable information to help meet students' expectations both during the current term and for future terms. Both successful and unsuccessful experiences need to be included. The instructor must be sure to address all concerns even if it's simply to explain why something was or was not done a particular way.

- Keep the faith--the effort is worthwhile

  Student logs and course evaluations from the second semester indicated that the course was a very beneficial and enjoyable one. They felt that the concepts learned from the course would enable them to function better in the business community.

CONCLUSIONS

There was a semester of great wailing and gnashing of teeth, and a semester of significant transition--that's the bad news. The good news is that the resulting course will provide significant benefits for students for many semesters to come.

Now that the course is functioning smoothly, students benefit from the following:

- Interacting with technology (Internet, GroupSystems, and Lotus Notes)
- Learning current and emerging topics
- Enhancing teamwork, collaboration and communications skills

According to student critiques, these benefits are gained through a process that is interesting, enjoyable and rewarding.

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APPENDIX A

The following syllabus has listed in parentheses and italics those changes that were made after the first time the course was taught. The syllabus for the second semester the course was taught reflected those changes.

DECISION SUPPORT SYSTEMS
CIS 615

Course Description:

The course explores the principles and application of decision support information systems with a focus on those decision support systems currently used in business. Executive information systems, expert systems, artificial intelligence, and groupware will be covered. Additional DSSs will be added to the course as they are implemented in business.

Course Goals:

The goals of this course are to:

- Teach DSS concepts, including their proper applications.
- Improve students' interpersonal and communication, teamwork, creative thinking and problem-solving skills.

Course Objectives:

- The student will be able to understand, synthesize and apply the following DSS concepts:

  Data management

  Decision modeling

  Group decision support systems

  Executive information systems

  Expert systems

  Artificial intelligence

  Data warehousing

  Data mining

  (Databases for decision support

  Intelligent agents

  OLAP

  Ethical issues)
- The student will be able to work collaboratively on a variety of activities.
- The student will be able to use (Notes and) GroupSystems for collaborative activities and know when the use of each is appropriate.
- The student will be able to use DSS tools, such as spreadsheets and databases, to make decisions.
- (The student will be able to collaborate with an International group.)

Textbook:

Decision Support for Management, Sprague and Watson, Prentice Hall, 1996.

Grading:

Grading Scale:

A = 90- 100
B = 80-89
C = 70-79
D = 60-69
F = Below 60

Grading Procedures:

A final grade for this course will be determined based upon the following criteria:

Case studies 35% (20%)

Nine (five) case studies will be done in class within groups. The groups will prepare the cases either using GroupSystems to facilitate collaboration or through face-to-face collaboration. All students will have the opportunity to participate in both methods of collaboration. The cases will be assigned during the previous class to provide time for reading before the class analysis. Grades will be based on thoroughness, accuracy, and presentation. Each member of the group will receive the same grade.

Group projects 30%

Two 30-minute group projects will be assigned on topics related to the DSS field. (Each student will prepare one presentation using face-to-face collaboration and one presentation using Notes for collaboration) Group projects will be graded on both the presentation and the submitted paper. Each member of the group will receive the same grade. Group members will evaluate the participation efforts of their individual team members. Less than equal participation will affect the participation grade.

Experience diary 10%

Each student will maintain a weekly dairy of their thoughts about their class-related experiences. The diaries will be completed using Notes. The students will record the main concepts covered in the class, concepts that need additional coverage, effective activities with suggestions for improvement, and problems encountered including possible solutions.

Grade will be based upon completeness.

Final exam 10%

(Midterm Exam 15% and Final Exam 15%)

A final exam will be given on the material covered in the course. The exam will consist of short answer and essay questions. The exam will consist of three parts. One part will be completed with face-to-face collaboration, one part using GroupSystems for collaboration, and one part by individual effort.

Participation 15% (10%)

Students will rate their team members on all participatory activities. Each student will divide 100 points among their team members reflecting their perception of each individual's participation towards the group activity.

(Students will be responsible for using the internet to become familiar with each topic in order to participate in class discussions.)

Students will complete weekly class evaluation forms.

Attendance Policy:

Although attendance is not required, the students is responsible for information and activities covered in class.

Participation grade will be affected for those activities that are missed.

REFOCUSING THE IS CURRICULUM: AN INDUSTRY PERSPECTIVE

Thomas Case
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At the 1996 IAIM conference, Case, Bialaszewski, Dick, and Newson proposed that emerging information age organization structures may provide MIS educators with considerable guidance when making IS curriculum revision decisions. They argue that the examinaton of the patterns that may be observed as organizations evolve and adopt information age organization structures can help identify IS topics that warrant greater emphasis within current and future IS S curricula. Courses and curricula developed via this approach may better prepare students for careers in 21st century business organizations.

This investigation was initiated to assess whether practicing managers perceive movement toward information age organization structures. It was also designed to measure to extent to which Australian managers feel that specific topics are increasing in importance. The implications of the findings for IS

INTRODUCTION/PROBLEM STATEMENT

At the 1996 IAIM conference, Case, Bialaszewski, Dick, and Newson (1996) provided compelling arguments that IS educators should take note of emerging information age organization structures when developing IS curricula. Advances in information technology (IT) have enabled business managers to reconsider how their organizations and work processes are designed and to introduce fundamental changes in organizational structures that contribute to sustainable competitive advantage in the global marketplace. Such changes include streamlining/reengineering of work processes, flattening of management hierarchies, establishing an appropriate balance of centralized/decentralized decision making, establishing closer relationships with customers and suppliers, and creating virtual corporations. These changes are resulting in the emergence of new organizational forms which can generically be called information age organization structures. Such changes are likely to require the development of new management approaches and the re-examination of content of MIS courses and curricula to ensure that students are adequately prepared for careers in 21th century organization structures.

Several organization forms are commonly classified as information age organization structures. These include horizontal organizations organized around (reengineered) core business processes, network organizations, virtual organizations (Davidow and Malone, 1992), internal market structures (Halal, 1994), and T-form organizations (Lucus, 1996). The emergence of information age organization structures is consistent with the observations of many noted writers/researchers including Cronin (1994), Hammer and Champy (1991), Handy (1993), Keen (1991), Keidel (1994), and Orilkowski and Robey (1991). Such organization structures are expected to become increasingly prevalent in the years ahead and to be the norm, rather than the exception, by 2010.

As noted by Case et al. (1996), the emergence of information age organization structures challenges IS educators to refocus IS curricula and to increase emphasis on topics that they predict to be especially important to organizations that adopt information age structures. These fall into four general topical categories: specific information technologies, application development, database systems, and information resource management.

Information Technologies Expected to Increase in Importance

Although communication and networking technologies have already assumed a prominent place in many IS curricula, the emergence of information age organization structures may require IS educators to pay even more attention them. Some of the topics that are likely to become more important as information age organizations continue to emerge include:

- Networking and communication technologies
- Internet, intranet, and World Wide Web technologies
- Video/teleconferencing technologies
- Telecommuting and other telework technologies
- Client/server computing technologies
- Groupware and workflow technologies
- Network operating systems and protocols stacks
- Remote access technologies
- Electronic commerce technologies
- Network management systems
- Laptop and mobile computing technologies
- Personal communication services
- Wireless communication systems/services
- Open computing architectures

Communication and networking technologies are the key components of the computing infrastructures of information age organization structures. This is especially apparent in virtual organizations, network organizations, internal market structures, and T-Form organizations. As a result of the emergence of these organization forms, networking and communications technologies are likely to come to forefront in IS curricula, while traditional computing technologies and topics are likely to lose the predominance that they have historically experienced in the MIS curriculum.

Application Development Topics Expected to Increase in Importance

Several application development topics are also expected to increase in importance with the emergence of information age organization structures. These include:

- Object-oriented programming and design
- Internet and WWW application development languages and tools
- Client/server application development
- Project-management
- Team programming
- Transorganizational application development
- Outsourcing and outsourcing management
- Application packages; commercially available business objects/applets

Object-oriented programming is expected to increase in importance because information age organizations with virtual components (such as network, virtual, T-form, and internal market structures) will require interorganizational applications that can be developed rapidly, preferably by leveraging ever-increasing libraries of custom and commercially available business objects. Web-oriented languages (such as Java and Perl) and web-oriented development tools/environments are expected to continue to increase in popularity keeping pace with increases in electronic commerce and Internet applications. Team programming and project management will become more important as application development teams composed of programmers from multiple organizations become more common.

Database Technologies and Applications Expected to Increase in Importance

Topical refocusing is also anticipated for database technologies and applications as information age organization structures become more prevalent. Changes in these areas include enhanced emphasis on:

- Distributed database systems and applications
- Client/server database systems and applications
- Object-oriented databases
- Database gateways/middleware
- Internet-based database applications
- Interorganizational database administration

Both distributed and client/server systems and applications are expected to be important to information age organizations that rely on interorganizational business partnerships (such as virtual organizations, network organizations, internal market structures, and T-Form organizations). Such business partnerships are likely to be dependent on the ability to leverage existing data resources within partner organizations (which will necessarily be distributed and often found on different platforms). Database gateways and middleware will be needed to enable communication among diverse distributed systems; the Internet is expected to be increasingly used for interorganizational (and intraorganizational) data access. As OOP becomes more common, especially for interorganizational applications, object-oriented databases and OORDMS will necessarily increase in importance. Data warehouses and interorganizational data warehouse management are also expected to increase in importance especially in organizations (such as those that implement internal market structures) that are interested in utilizing data mining to identify probable and/or untapped markets for their products/services.

Information Resource Management Topics Expected to Increase in Importance

The emergence of information age organization structures is also expected to have important implications for information resource management. Topics expected to become increasingly important in the years ahead include:

- Information architectures/infrastructures
- Interorganizational MIS planning/coordination
- Managing virtual MIS professionals
- Strategic data management
- Managing MIS partnerships

As noted above, virtual of MIS professionals and managing them will become more important as transorganizational application development teams become more prevalent. MIS planning is expected move beyond the ever-present challenge of coordinating MIS plans with organization-wide strategic plans. In information age organizations, MIS planning and coordination will often have to consider the strategic initiatives of multiple business partner organizations. Managing MIS partnerships will become increasingly important and, in many instances, this will encompass more than managing IS outsourcing relationships.

Business/Management Implications of Information Age Organization Structures

As noted by Case et al. (1996), the emergence of information age organization structures have important implications for the business curriculum beyond MIS. For example, the increasing prevalence of team-based organizations (such as process-centered and horizontal organizations) and networks of individuals/teams that cross traditional organizational boundaries will pressure business managers to develop *teamwork-oriented skills*, both as team leaders and team members. They must also be able to develop (interorganizational) team structures that facilitate the assimilation of new members as team support structures that enable the work groups to be productive.

Managers whose organizations are involved in *alliances* with other organizations will be increasingly challenged to balance current cooperation with potential (future) competition. They will be required to develop and manage the systems that govern information flows with allied organizations as well as systems that maximize organizational learning from the alliances.

In network organizations, strategic alliances with business partners and many flat organizations, managers will not be able to rely on traditional authority systems and chain of commands to get things done. When working on teams with people in different departments (or organizations) that have different sets of priorities and incentives, managers will have to develop effective *negotiation skills*; they will have to learn to identify the interests and needs of people whose cooperation they must have and to identify "win-win" situations in which everyone involved benefits from such cooperation.

New incentive systems will be needed for information age organizations; new career concepts that involve horizontal movement rather than vertical movement (via promotion) up the once tall organizational hierarchy will also be needed. Twenty-first century managers will be particularly challenged to developed team-based incentive systems that balance individual contribution and group performance. Effective incentive systems for cross-organizational teams may be especially challenging for managers to develop.

In flat, team-based firms and organizations that are simultaneously involved in multiple network organizations or business partnerships, most managers and workers will be concurrently working on several projects or teams. Hence, it is important for them to develop *multitasking* skills—the ability to manage one's time and commitments so as to be able to work efficiently on several tasks.

Over the long haul, organizations that are able to learn from their experiences in strategic alliances, business partnerships, and network organizations will be best positioned for future growth and survival. Managers must become adept at developing *organizational learning systems* that capture lessons learned from the organization's involvement with other organizations and that include mechanisms for sharing the knowledge with other parts of the organization.

For organizations that implement globally-based internal market structures, *cross-cultural communication skills*, and *cross-border integration skills* (the coordination of activities that occur in different countries and contexts) are likely to be important managerial abilities. Stakeholder management (managing relationships with groups that have a stake in the survival and performance of the organization) is also likely to be especially challenging because with international operations, the range of stakeholders typically increases along with the chance of contradictory pressures from them.

The emergence of Information Age organization structures also implies that today's business students should master organization development and *change management* concepts/skills. Future managers must become adept at implementing new organization structures and incentive systems and for addressing the inevitable resistance that these changes will meet. In internal market structures, for example, change will be continuous: new business units will be created as others are being dissolved. Effective change management is likely to be crucial in such organizations.

Focus of the Current Investigation

The prediction that the topics listed above will increase in importance is based on the assumption that information age organization structures will become the norm rather than the exception within a decade after the turn of the century. Organization restructuring is a business decision made by business managers and other key organization members. As a result, they (business managers and professionals) are ultimately responsible for determining whether these predicted changes will occur. If practicing managers do not perceive that their organizations are moving toward information age organization structures, the predicted changes in IS topical importance may not be realized.

The current investigation was initiated to determine whether practicing managers and business professionals perceive their organizations as moving toward information age organization structures. In general, we expected practicing managers to demonstrate general agreement with the trends identified by Case et al. (1996) and to report increasing importance for key topics identified in the foregoing technology, application development, database, information resource management, and business management sections.

METHODOLOGY AND RESULTS

To test these a survey instrument was constructed. The content and focus of the survey instrument was intended to assess business manager/professional perceptions of the emergence of information age organization structures and to identify topical areas that they perceived to be increasing in importance. (Please contact the authors for a copy of the survey instrument.

The population chosen for this study was students in the *Information Technology for Managers* classes of the Master of Business and Technology (MBT) programme at the University of New South Wales in Sydney, Australia. The industry-linked MBT programme is a result of collaboration between a number of major Australian companies and the University, and aims to provide management skills in range of technologies to suit both professionals and managers with limited technical expertise.

The Data

The results discussed below are based on the first administration of the survey to 66 MBT students, which has provided the investigators with the opportunity to summarize data from a significant group of professionals and managers. The group was predominantly male and relatively young – see Figures 1 and 2 below.

FIGURE 1

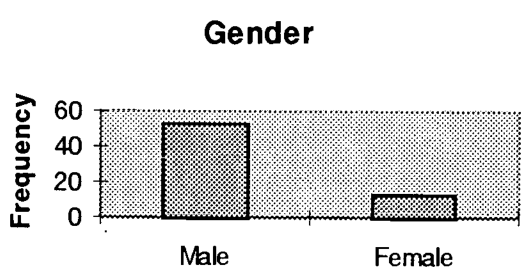
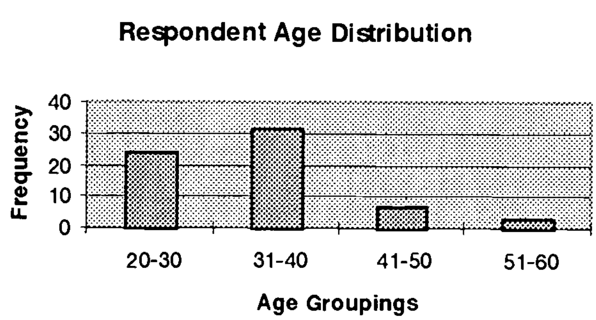


FIGURE 2



Survey respondents typically come from a professional background (the average time as a manager or professional was 2 - 5 years) and most make considerable use of information technology in their work - the average respondent had 5 - 10 years computing experience. Most of the respondents rated their computing abilities above halfway on a five-point scale ranging from "novice" to "expert". For an overview of the demographic data, see Figures 3 – 5 below.

FIGURE 3

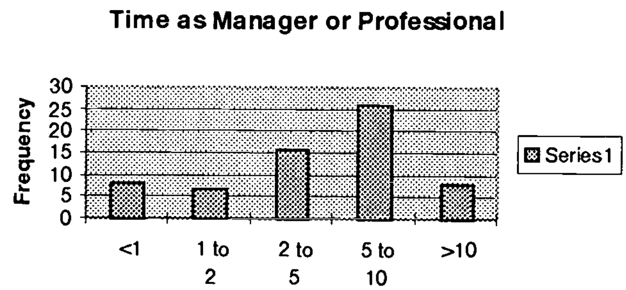


FIGURE 4

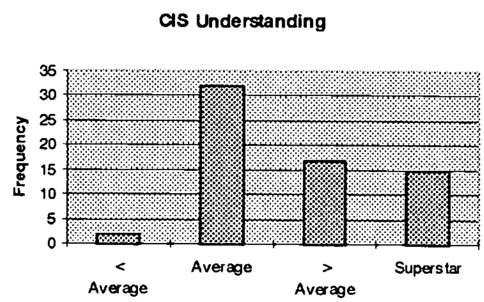
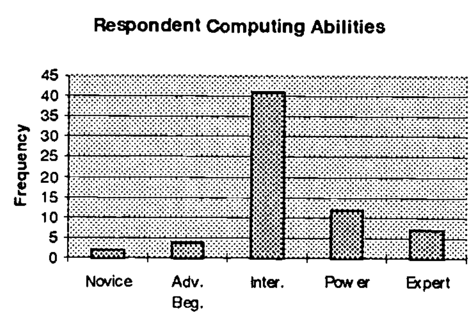


FIGURE 5



It can be seen from the above graphs that this group has a strong background in computer information systems and significant managerial or professional responsibilities. As such they are well placed to comment on issues related to the emergence of information age organization structures as well as IS topics that are increasing in importance in their organizations.

In the questionnaire administered for collection of the survey data, respondents were asked to indicate their agreement with a series of statements, on a five point scale, ranging from *Strongly agree* to *Strongly disagree*. These responses were then graded from 1 to 5 giving an overall Neutral response a mean of 3.

Technologies

A large number of respondents agreed that the key technologies identified, particularly

TABLE 1

TECHNOLOGY ISSUES

Statement	Mean	Standard Deviation
1. The Internet will significantly change the way my job is done over the next five years.	2.6	1.10
2. Video-conferencing technologies will become more prevalant in my organisation in the near future	2.3	1.02
3. Wireless telecommunications are being increasingly utilised in my organisation.	2.4	0.97
4. Telecommunication technologies have assumed a central role in the information architecture of my organisation.	2.5	1.06
5. Client/server computing is increasing in importance in my organisation.	2.0	0.72
6. Data warehouses are increasing in importance in my organisation.	2.5	0.99
7. Network bandwidth is! an important issue in my organisation.	2.1	0.85

TABLE 2

APPLICATION DEVELOPMENT ISSUES

Statement	Mean	Standard Deviation
1. Team-based structures are becoming more prevalent in my organization.	2.3	0.99
2. "Virtual teams" is the way teams will work in the future, with members using telecommunications and computers to work together.	2.8	1.03
3. In the years ahead, outsourcing will be applied to an increasing number of my organization's business operations.	2.2	1.08
4. Project management skills are becoming more valuable in my organization.	1.8	0.79
5. Team development and team management skills are growing in importance in my organization.	2.0	0.75
6. Groupware is incresingly bineg used to support the activities of growps and work teams in my orgaization.	2.5	0.85
7. Object-oriented programming is increasing in importance in my organization.	2.6	0.83

networking and communications, the Internet and WWW, video and teleconferencing, client/server, wireless communications (and remote access), will have an increasing impact in the workplace. The following table gives an overview of the results for a range of issues by providing the means for each statement.

System Development Issues

Application development topics seen as particularly important included project management and outsourcing. Still important, but less so, were object-oriented programming, client/server applications and Internet-related tools. (See Table 2.)

Telecommuting

Telecommuting and remote work was seen as a mode of work increasing in importance with most respondents agreeing it is becoming commonplace and holding an expectation that all workers, but particularly managers, will be expected to work additional time at home. In this vein, most respondents have most of the essential "electronic enablers" of a PC and or laptop, a printer, a modem and a cellular telephone in their homes now (per capita, Australia is third in the world for the number of cellular telephones.) The number of respondents with modems at home was 69% (expected to increase to 83% in the next 2 years), 56% have a connection from home to the Internet (expected to increase to 81%) and while 20% currently have a 2nd telephone line, this is expected to increase to 50% in the next 2 years. Interestingly, while these results indicate a significant increase in the demand for a second telephone line, it seems the demand for cellular telephones may be leveling off. This data would certainly indicate that working from home will be facilitated by the take-up of these technologies and that virtual workers will be important parts of 21st century organizations.

Work Practices

It was the general area of changes to work practices and managing change that was identified by the respondents as having the most significance. The most important challenges perceived to be facing managers and professionals include finding new ways to use technology in the workplace and to improve decisions, outsourcing, telework (telecommuting and mobile computing), managing change, the impact of re-engineering business processes, and the acceptance of IT as a key to long-term competitiveness and a tool for re-shaping work. The respondents did not see re-engineering of business processes as a threat, instead they saw it as important in their organisations and looked forward to the use of IT to help in this process. Most respondents seemed to be relishing the

TABLE 3

Statement	Mean	Standard Deviation
1. I look forward to finding new ways to use new technology to help me in my job.	1.5	0.53
2. I feel that information technology enable s me to make better decisions.	2.0	0.74
3. As a manager, the implications of introducing new information technologies are particularly important to me.	1.9	0.61
4. Telecommuting and mobile computing are becoming more commonplace in my organization.	2.6	1.18
5. Information technology is enabling my organization to enhance its creativity and innovative potential through strategic alliances with other organizations.	2.5	0.85
6. Information technology is continually changing business processes within my organization.	2.1	0.79
7. Managing change is becoming an increasingly important aspect of my job.	1.8	0.81

opportunities that Information Technology might offer – they felt strongly that it enabled better decision making, saw the !implications of its introduction as particularly important and indicated that managing change was an increasinly important aspect of their jobs. A summary of the responses to key questions are given in Table 3.

DISCUSSION AND CONCLUSIONS

In addition to providing a "snapshot of perceived hot skills", the data also lends support to the contention that the changes that are taking place in organisational structures and processes are likely to provide some guidance to IS educators in setting the curriculum. The data seem to indicate that Australian managers and professionals tend to agree that the types of information technologies identified as key components in computing infrastructures of information age organizations are, in fact, increasing in importance. These managers and professionals also demonstrated general agreement that the types of application development approaches considered to be most suitable for information age organization forms are also becoming more important in their organizations. In general, these findings provide support for our predictions.

These results suggest that business managers and professionals agree that emerging information age organization structures are also having an impact on business management practices and challenges. Both work and business processes are perceived as being significantly impacted by information technology. Telecommuting and an increased prevalence of virtual workers are perceived as posing key management challenges. Consistent with these trends, Australian managers and professionals see project management and change management as being increasingly important management skills.

Curriculum Implications

The current investigation and Case et al.'s 1996 IAIM paper have significant curriculum implications for IS educators. Several of these are highlighted below.

The first curriculum implication stems from the growing need to ensure adequate coverage of communications and networking technologies. The results of this investigation suggest that networking and communication technologies will continue to emerge as key components of the organization's computing architecture and infrastructure. As such, there is likely to be increasing pressure on IS programs to require IS majors to complete at least one course in business telecommunications; offering it as an elective may no longer be an option. IT-intensive courses (such as the introductory course) may transform into *Media 101* courses in which networking and communication technologies are covered at least as extensively as traditional computing technology topics. Over time, traditional computing technology topics may play lesser roles in such courses and may be overshadowed by coverage of networking and communication technologies. In sum, computing may become a subset of business telecommunications in the years ahead.

Our results suggest that OOP and Internet application development (including languages and tools) are likely to become more important in IS application development courses and curricula. Our results also indicate that importance of project management as an application development topic is especially likely to increase. The results also suggest that application development courses should devote more attention to client/server application development, groupware applications, managing virtual application development team members, business process reengineering, and outsourcing application development.

The information resource management implications of our findings include enhanced coverage of IT's ability to enable organizations to implement information age organization forms, to re-shape work and business processes, and to provide the organization with sustainable competitive advantage. Managing and supporting the virtual workforce, including virtual MIS professionals, also seems to deserve considerable attention in information resource management courses. Information resource management courses should also concentrate more extensively on outsourcing management and managing relationships with business partners.

In general, our results also suggest that information management courses and MIS service courses should devote more attention to information age organization structures such as network organizations, virtual organizations, strategic alliances, T-Form organizations, internal market structures, and process-centered organizations. As organizations continue to move toward such structures, IS and business educators are challenged to prepare students for life and survival in these new, emerging organization forms. Such preparation begins with adequate exposure to these organization structures within IS and business curricula.

Limitations and Future Directions

An obvious limitation of this research is that to date, it has been conducted in only one country and on a particular group of managers (those enrolled in the IT for Managers course in the MBT programme at the University of New South Wales.) To address this limitation, the authors would welcome the opportunity to share their data and the survey instrument with colleagues willing to do comparative studies involving a broader range of respondents.

A second limitation is that the survey instrument does not provide an exhaustive test of Case et al.'s (1996) predictions concerning increasing importance of specific IS topics. A more comprehensive survey instrument administered to multiple (international) samples would provide a better test of the accuracy of their predictions.

The third limitation is largely conceptual in nature and concerns the consistency between curricula derived from the evolution of organization structures and the AIS/AITP/ACM IS Curriculum Model. That is, to what extent are topics relevant to information age organizations addressed in the curriculum model's learning units? Are there unaddressed topics beyond the learning units or are the learning units sufficiently robust to address the topical changes that Case et al. expect? Such a comparison at the learning unit level could provide an avenue for assessing the curriculum model's resiliency.

Other useful avenues for future research include longitudinal assessments of employer demand for the types of skills, knowledge, and abilities to see if they predictably increase in importance. Research examining the number of business organizations that actually implement information age organization structures also seems warranted.

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DO I/S STUDENTS VALUE INTERNSHIP EXPERIENCES?

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Internships are often put-off until late in some students' programs of study. Furthermore, some academics are said to be reluctant to accept the legitimacy of applied work programs and thus cooperative education programs are not offered in some curriculums. This study invited students finishing their internship experiences to reflect on the legitimacy of internships as a method to prepare students for career as computing professionals. The student subjects in this research were all computing majors (Computer Science, Information Systems, Telecommunications). The results reported in this study are based on two data collection methods. Fixed format scaled responses from a small sample were used to gather and analyze description statistics of graduating interns' perceptions. In addition, open format responses were evaluated, coded and summarized from a larger super-set sample. Student responses were strongly favorable concerning their internship experiences. Most students described the internship as a great experience that had a major impact on their learning and on their understanding of real world issues and environments. Surveyed students overwhelmingly recommended that other students get involved in cooperative education opportunities.

INTRODUCTION

Large employers increasingly demand work experience when hiring new college graduates. Cooperative education based industrial internship programs provide students an opportunity to gain work experience in their area of professional study. Furthermore, an internship demonstrates that the student is both informed and serious about their career direction. The significant impact of real-world experience is supported by the report that over 90% of recruiters say internship experience is viewed as an important factor in screening job applicants' resumes (Wilson 1997). Internship programs potentially provide benefits to the student intern, to the sponsoring organization, and to the academic department facilitating the cooperative education relationship.

Potential benefits to the student include: the opportunity to gain real-world work experience that is valued by industry recruiters; the opportunity to verify their interest and desire to pursue a career in a given profession or specialty area; the opportunity to learn more about a potential permanent employer; the opportunity to become more aware of the skills most valued by industry; the opportunity to select courses and steer their remaining course-work based on enhanced perspectives gained during their internships. In addition, student interns gain valuable skills, confidence, and the cogent prospect that they will reinforce previous course-work and better understand course topics by framing the concepts in terms of analogies and perspectives gained during real work experiences.

In return for their mentoring investment, sponsoring corporations obtain relatively inexpensive professional labor while concurrently conducting a pro-longed interview as a basis for hiring decisions. Moreover, a mutually successful internship experience enables an advantageous personal relationship that facilitates recruitment of the student following graduation (Tobias, 1996). Furthermore, the organization may gain new perspectives or practices based on new technologies and techniques that the student intern transfers from their university experiences.

The academic department benefits by strengthening their relationships with industrial partners while also obtaining feedback concerning the quality of their academic product (valued student/graduates). Moreover, feedback from both the sponsoring organization and the student interns provide insights to the skills being sought in industry. These insights assist the department's ongoing efforts in curriculum development and refinement.

Although several sources indicate students gain value from the internship experience (Tobias 1996; Wilson 1995), the evidence to support benefit claims is largely anecdotal. For example, the Association for Computing Machinery (ACM) career consultant, Jack Wilson, says it is extremely important in today's business environment to show evidence of relevant work experience. When university graduates are competing for top jobs at top companies they should expect to face tough competition from other academically qualified candidates. According to Wilson, "when you are competing for employment with other great students from good schools, with good grades and skills, your relevant work experience can make a big difference."

While the benefits proposed seem relevant and realistic; it is not evident that everyone concludes the benefits are real. In our academic program students are highly encouraged (semi-mandated) to participate in a relevant computing related internship. While a large proportion of our students seem eager to gain an internship experience, others are less enthusiastic, and some are skeptical about delaying their entrance into the real job (permanent employment) market. A few even voice the opinion that the internship program is a university supported industrial conspiracy to co-opt talented professional labor at below market wage rates.

RESEARCH QUESTIONS

The purpose of the study described in this manuscript is to analyze data that may empirically support claims related to benefits incurred by student interns. The research questions being evaluated are summarized in Table 1. The research focuses on student perceptions concerning the benefits of participation in cooperative work-study programs. Particularly we are interested in the "learning" that takes place during an internship work experience, as well as potential career direction and job placement benefits. We anticipate these findings will be meaningful to our future students, to curriculum planners, to the faculty supporting the internship program, and to our many industrial partners who continue to demonstrate increasing interest in sponsoring internship contracts.

METHODOLOGY

Graduating internship students are used as the data source in order to obtain credible results in the minds of prospective internship students. Graduating internship students are defined here as students who have successfully completed an internship experience; however, these students normally have more course-work to complete before they will graduate from our Applied Computer Science degree program. The analysis of survey data was conducted in two ways. First we conducted an analysis of previous student comments concerning internship experiences. This included parsing, coding, categorizing, and summarizing student comments regarding their internship experiences. These comment categorizations were then used in conjunction with a literature review to construct a Likert-type scaled survey instrument. The closed-format survey used a five point scale ranging from 1=Strongly Agree to 5=Strongly Disagree.

The scaled survey instrument was completed by a subset of our Summer 1997 student interns. The scaled survey subset is composed of students who returned their standard internship evaluation forms during regular office hours and thus could be requested to complete this supplemental survey. Results reported in this study are based on the small sample (n=18) of scaled survey responses along with a representative sample of student comments from a larger sample (n=76) who submitted a standard internship evaluation used by our cooperative education office. Open format narrative responses were culled from optional student replies to the question "What

TABLE 1

RESEARCH QUESTIONS

The following research questions are based on the perceptions of graduating internship students.

1. To what extent did the internship provide an opportunity to gain real-world work experience that seems to be valued by industry/recruiters.
2. To what extent did the internship provide an opportunity to verify whether to pursue a career in the I/S profession.
3. To what extent did the internship provide an opportunity to learn more about a potential employer.
4. To what extent did the internship provided an opportunity to gain confidence in professional skills and capabilities.
5. To what extent did the internship provide an opportunity to learn valuable skills that would be difficult to learn in a classroom.
6. To what extent did the internship provide the background to better understand course-work by comparing course concepts to real world computing experience.
7. To what extent did the internship provide an opportunity to gain awareness of what skills are used and valued in the workplace.
8. To what extent did the internship enable improved interpersonal communication skills.
9. To what extent did the internship enable improved technical skills.
10. To what extent did the internship provide an opportunity to redirect computing studies toward specific areas of interest.
11. To what extent did the internship provide an opportunity to select courses based on a more informed perspective.
12. Overall, how enjoyable was the coop experience?
13. Overall, how valuable was the coop experience?
14. Would you recommend that other students participate in a coop/internship experience?

would you tell other young ACS majors trying to decide whether or not to become involved in the Cooperative Education Program?" Narrative responses were parsed into 145 comments that were then coded for classification. These open format narrative comments are used to add richness and to supplement the descriptive statistical analysis.

RESULTS

Student responses provide strong evidence that the internship experience is worthwhile and valuable. Table 2 illustrates the percent of respondents who strongly agreed (item response=1), the mean score for the item on a five point scale, and the standard deviation. The survey items' number reflects the research question from Table 1.

Responses to the first research question show near unanimous agreement that student interns perceive the experienced gained to be valuable in terms of industry recruitment. All respondents responded with agree or strongly agree concerning the value of their real-world experience. Eighteen parsed comments relative to this question included several declaring job offers, others noting prospects for future employment with their coop sponsor, and others declaring valuable experiences that would help build their resume.

Responses to the second research question shows strong agreement that the internship helped to verify their desire to pursue a career in the computing profession. All respondents were in agreement on this item with the exception of one person who provided a neutral response. Coop experience allows students to get a taste of the real-world and thus to verify whether their targeted career area is in fact something they really want to do. For example, "Coop is a great experience - I got a taste of what my future job/career will be like" was reported by one student. In some cases real-world experience can also help confirm areas in which the person does not want to work. For example, one student commented "my coop helped me realize I don't want a career in COBOL coding."

Responses to research question three demonstrates widespread agreement that the internship provided the opportunity to learn more about a potential future employer. Only eleven percent of respondents were neutral concerning this item. In correspondence with all scaled item responses presented in this survey,

TABLE 2

DESCRIPTIVE STATISTICS REGARDING INTERNSHIP EXPERIENCE.

Survey Item Focus	% Strongly Agree	Mean Score	Standard Deviation
ITEM 1: valuable real-world experience	88.9	1.1111	.3234
ITEM 2: verify decision on I/S career	72.2	1.3333	.5941
ITEM 3: learn more about a potential employer	66.7	1.4444	.7048
ITEM 4: gained confidence in my capabilities	66.7	1.3333	.4851
ITEM 5: learned skills difficult to learn in classroom	66.7	1.3889	.6077
ITEM 6: background to better understand course-work	50.0	1.6111	.6978
ITEM 7: gained awareness of skills valued in workplace	55.6	1.4444	.5113
ITEM 8: improved my interpersonal skill	61.1	1.4444	.6157
ITEM 9: improved my technical skills	66.7	1.4444	.7048
ITEM 10: helped re-direct my studies to area of interest	38.9	1.7778	.7321
ITEM 11: enables course selection from more informed basis	33.3	1.7778	.6468
ITEM 12: Overall, how enjoyable was the coop experience	61.1	1.3889	.5016
ITEM 13: Overall, how valuable was the coop experience	77.8	1.2222	.4278
ITEM 14: (Yes/No item)	100.0		

there were no responses indicating disagreement with the statement. This limited response variance is reflected in the low standard deviations and seems to reflect widespread respondent agreement concerning the benefits associated with their internship experience.

Although the intern program is not intended to lead directly to job offers, several students reported in the free-format evaluation responses that they had accepted jobs with the internship sponsor. This corresponds with verbal comments received from many near-graduation seniors that they intend to start work with their internship sponsor. In addition to "firm" job offers for more senior students, several less advanced students commented on the internship as "a great way to get your foot-in-the-door with a good company" by building a network of business contacts.

Responses to research question four and five demonstrate that 2 out of every three students perceived the internship experience to have increased their professional self-confidence while also providing an opportunity to learn valuable skills that would be difficult to learn in a classroom environment. Student comments indicate learning to work cooperatively in large project teams, and to gain awareness of business etiquette, politics, and ambiguity. In addition, students learned that they can be successful in the semi-structured context of the real world and that there is value to the skills and knowledge they have been gaining from course-work. For example, one student commented that "coop builds confidence in your abilities and the value of what your learning (in class)."

Responses to research question six indicate that half of the respondents believe their internship will improve and benefit their understanding of course concepts by providing real-world experience for comparison and analogy. Narrative responses note the internship was valuable not only for learning new things but also for reinforcing skills learned in the classroom.

Responses to research question seven showed that most students strongly agree and that all respondents agree their internship gave them a better awareness of what skills were used and valued in the workplace. Narrative comments suggest some benefits in viewing new technologies and viewing technological trends.

Responses to research question eight and nine demonstrate that the internship enabled students to enhance both their interpersonal communication and technical skills. Many respondents commented that more learning occurs during the coop than in most classes. This tendency was especially salient in regard to soft skills, teamwork, and an appreciation for organizational environments and the realization of uncertainty. Importantly, all but one student agreed that their interpersonal communications skills were improved by their internship. "Soft skill" enhancement was also supported by narrative comments.

Responses to research question ten and eleven display agreement concerning the value of internships to enable more informed direction and decisions concerning the targeting of personal academic programs and courses toward specific career interest areas. Analysis of free-form comments indicate that for some students the internship experience came too late in their degree program because their few remaining courses were pre-determined by degree requirements. Other comments noted that the internship experience reinforced existing course-of-study plans rather than enabling new decisions. For example, one student stated "I only became more convinced that I want to take a course involving the design and implementation of web pages." Another student noted that "coop is a good idea; early in curriculum it can reshape your education." Another advantage of an early curriculum internship experience is that it allows for multiple coop experiences in varied work settings. As noted by one aspiring coop enthusiast "Coop is a great experience - I plan to do it again!"

Responses to research question twelve informed us that all fixed-format respondents found their internship to be enjoyable. Moreover, responses to research question thirteen demonstrates the students' perceived value of participation in an internship assignment. Nearly 80% of participants "strongly agree" and all others "agree" that the internship experience was valuable. Student comments, such as, "the intern experience is invaluable" leave little doubt as to the perceived value of time and efforts devoted to the internship program. In the words of another student "Do it! Coop is a great experience, plus you get paid!"

Responses to research question fourteen strongly support the wisdom of "Just Do It". Item fourteen asked for a simple Yes/No answer to the question "Would you recommend that other students participate in a coop/internship experience?" Unanimous (100%) agreement to this question indicates that internship experienced students overwhelming support the merit of cooperative education programs. While many narrative responses encouraged future students to take advantage of internship opportunities, several stronger comments declared the coop experience "should be absolutely required."

DISCUSSION AND LIMITATIONS

Unanimous agreement, such as demonstrated above for item fourteen, is surely in-part an artifact of the small sample used for analysis of scaled responses. Nonetheless, the free-format responses received from a larger sample were also nearly unanimous in supporting the value of internship experiences. Even the few negative comments received did not contradict the learning or professional value of a coop experience. The few negative comments received were focused on either paying fees for internship course credit, or a feeling that the student had been placed in a non-challenging or unpleasant work context. For example, one student protested "I don't see why we are required to pay ISU for internship hours -- I found the job myself and used no ISU resources!" In contrast to this complaint other students noted "it's great that working got me school credit" and that the coop office made finding a placement easy. Another less enthusiastic student noted "it wasn't the experience I was hoping for but now I have a better perspective on the real world." This last, somewhat negative, commentary suggest the student had in fact actually valued (if not enjoyed) the internship experience.

Recapitulating, virtually all scaled survey responses show coop graduates' perceived multiple benefits and value in their internship experience. Furthermore, approximately 98% of 145 parsed comments were favorable regarding the internship program. Moreover, the fact that intern graduates were willing to spend time preparing comments to share perceptions about their internship experience is further evidence of their enthusiastic interest level regarding the coop/internship program.

The following student comments capture the essence of perspectives gathered from student comments. From one pragmatic student we heard "It's (Coop) a great deal. You get course credit, work experience, and you get paid." A more learning focused comment proclaims, "the amount of knowledge you gain through a coop is incredible." Furthermore, a student providing counsel for new computing majors stated, "I would definitely encourage other students to participate in an internship. The internship provided me with a real sense of how the business world operates and enabled me to apply the knowledge I learned in the classroom to a real world situation." Finally, a senior student claimed the most pragmatic of benefits, "Great news! I will begin full-time employment with CAT in August."

In conclusion, students who have completed internship experiences highly recommend that other students invest in the opportunity to participate in cooperative education programs. The benefits perceived and reported by students include recruitment advantages, an excellent method of learning, better understanding of organizations and career focus, as well as reinforcement of course learned skills and enhanced confidence in their own professional capabilities. For institutions that are interested in serving the needs and values of their student stakeholder this research sends a clear message that students strongly value internship experiences. Institutions, faculty, curriculum planners, future students, and parents need to be aware of the very positive findings concerning participation in cooperative education workplace experiences.

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SIX THINKING ASPECTS OF PROGRAMMING

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Based of literature and student input, six major concerns have been noted for student programming progress for the academic class and work environment. The areas of concern are module driver programming, program documentation, output and data design, data validation, and reusable code. Each area has been analyzed and examined in the teaching of computer programming over a period of about twenty years. The key element continues to be thinking. Getting programming students to think about each of the concerns and applying those principles to their environment leads to a better programmer.

INTRODUCTION

After reviewing student's comments from course evaluations on the programming class for over 20 years, a continuing concern regarding thinking prevails. In addition to the normal course evaluation, the author continues to periodically evaluate class topics in the programming course to determine clarity of presentation and to follow-up student questions or lack thereof in the class. Students believe that the major effort for the programming course is getting the correct answer to the programming problem. But life normally does not have just one answer and that mirroring is not realistic. While the concerns expressed from students relate to the COBOL programming course, much of the material is tangential to almost any language. Even in home page design and its coding, the relationship of the concerns has been noted by and to students. Programming-related concerns have been noted by students and thus should be addressed more by faculty in the process of teaching programming courses – no matter what language is used. Over the last twenty years, six major concerns continue to be expressed by students over the last twenty years have been the following:

a. module driver programming
b. program documentation
c. output design
e. data design
e. data validation
f. reusable code

In the first years of teaching, the faculty member normally leans heavily on the textbook and its ancillaries. As teaching time passes, the faculty member should be aware of the fact that books change but many of the programming constructs continue. The textbook provides one view in the logical progression on programming plus examples for the student to follow in that progression and finally situations to program which illustrate the progression of topics. The programming assignment should not just be a coding assignment but a means for the student to think about results for the user and what really is involved in the process. This is leading to a more realism, which seems to be a missing element for the student. No matter which textbook is used, the faculty member should be providing an instruction mode to student learning not just lecturing from a book.

MODULE DRIVER PROGRAMMING

One of the first concerns given by students centered on the aspect of structured programming, which leads to the module mode of programming and thus the driver programming method. GO-TO programming was the way programming was initially taught. Then structured programming made the GO-TO verb fade – in BASIC, COBOL, dBASE and _____ (insert your choice of language). Programming in the middle of the seventies was starting to emphasize the structured approach and changed the process of programming. An experienced programmer taking an academic course generally fought with the faculty member who used the structured approach based on the process of "getting the program completed". The author vividly remembers arguments with working students who would argue about being able to code the program faster by ignoring structured concepts. Coding the program was easy but the thinking part really caused students some concerns. Over time structured methods prevailed and thus the module driver approach appeared. In the sixties, the author remembers the COBOL programming course in which four programs were the normal number written for the whole course. When the structured methods were applied much more coding could be accomplished. The applied theory of the New York Times programming project directly effected the academic expectation of programming. With the driver method in COBOL, the academic level of programming approached at least 30 statements per day per credit hour production.

In pushing students, two studies were attempted to note programming prowness. For about two years, a now retired faculty member and the author controlled the programming level of students using the academic quarter (10 weeks with 4 fifty-minute meetings weekly). The initial failure rate in classes was high based on students not allocating the expected time for class as requested by academic theory – at least one hour of outside class time devoted to the class for every hour of class. After students accepted the time expectation in programming, the passing rate climbed. In fact, the "A" grade rate was so high that questions arose on giving grades in the class. Students were most inclined to complete the work at a high level based on the expected first job being in COBOL programming. In the last three years, the grades have come down, based mainly on students finding out that programming required much thinking and also the fact that companies were hiring less programmers. In the last year, the intensive COBOL seminar approach has increased based on the lack of COBOL programmers and the year 2000 project.

In teaching the module and driver approaches, the student had to think in a manner that the whole is made up of several parts, and thus the student tried to solve programs in pieces. The building module approach has again increased the level of student coding with the number being between 30-50 statements per day. This was not the only reason for the programming increase but seemed to be the root of the solution. The microcomputer with its availability of compilers has also played a part in productivity.

With the driver approach, the student better organized his or her thoughts to come to a conclusion. The author provides a series of generic programs for the whole process which follow a building approach for listing, calculations, totals, page breaks, conditional logic, control breaks, sorting, tables, and screens. The course problems also lean heavily on the building approach but requires design thinking for the student. [A sample set of programs noted in this section is available in the public domain.]

PROGRAM DOCUMENTATION

The author brings into class what is left of a 50-page program of the early seventies with no documentation and asks several questions of the students in the class about the program after the initial programming lectures and first student program. The general student comments deal with the junkiness of the production program, which came from a Fortune 500 company. Program documentation should be emphasized in any class in which some level of programming is attempted. Program documentation includes not only internal comments but data name construction rules for field and calculation clarity.

Even when HTML is discussed in the creation of home pages, the program comment aspect is explained and required to aid the student in further refinement of the code – even when most of the class are not computing majors. As a part of any programming class, program documentation should be emphasized. In reviewing over 167 course outlines from an Internet search, only twenty-seven (27) outlines had the topic of documentation as part of lecture materials and six (6) outlines had an internal document on standards that should be applied to programming assignments. From work experiences with the US Army, their Computer Science School previously provided a fifteen-page document on standards and program documentation. Dr. Janet Hartman of Illinois State University had standards on her Web page for her C programming class. From other research and faculty interaction on the topic, Dr. R. Wayne Headrick of New Mexico State University, has a programming standards handout, which details program documentation and COBOL coding standards, which is also, noted on his course web pages.

For COBOL, minimum standards include general programming conventions, internal program comments, spacing, data name conventions, and module name conventions. Some of the general programming conventions include:

IDENTIFICATION and ENVIRONMENT DIVISION considerations:

a. IDENTIFICATION and ENVIRONMENT DIVISIONS can be placed on separate pages by placing a / in column 7.

b. The sequence in which files are selected in the SELECT statements is not critical, but the more logical approach is to select and define the input file(s) first and then the output file(s).

c. Code each SELECT statement on two lines and avoid the use of device-specific file-names such as SALES-DISK.

PROCEDURE DIVISION considerations:

a. A Mainline or Driver module should control execution of the program modules in the PROCEDURE DIVISION. That module should be the first module in the PROCEDURE DIVISION.

b. Each program module should include only the statements required to accomplish a process.

c. Each READ and WRITE statement required by the program should be coded into a separate program module.

d. STOP RUN should be the last executed statement in the Mainline or Driver module.

e. Only code a single statement per line for the sake of clarity and to make debugging easier.

Internal Program Comment Requirements:

a. Immediately following the IDENTIFICATION DIVISION, there should be comments that indicate the overall function of the program. So that the comments can be easily identifiable as documentation text, proceed and follow the comments with a line of *s.

b. With the exception of the Mainline and Initialization modules, all program modules in the PROCEDURE DIVISION must be proceeded by comments that indicate the purpose of the module.

Spacing Requirements:

a. All indentation should be made in increments of four spaces.

b. All PIC and VALUE clauses must be aligned.

c. If a COBOL sentence is too long to fit on a single line, the second line must be indented four spaces.

d. All "blank" lines should have an * in the 7th column with the rest of the line being blank.

e. All division headers, with the exception of the IDENTIFICATION DIVISION should be proceeded by two or three "blank" lines.

f. All section headers should be proceeded by one or two "blank" lines and followed by one "blank" line.

g. All file descriptions (FDs) should be proceeded by one "blank" line.

h. All 01-level record descriptions should be proceeded by one "blank" line.

i. All PROCEDURE DIVISION program module names should be proceeded by one "blank" line and followed by one "blank" line.

Data Record Naming Conventions:

a. All program accumulation, computation and control fields should have a prefix or suffix of WS. Temporary fields of this nature should have similar fields grouped together at the 01 level, then each individual field listed at the 05 level.

b. All input data record and fields should have a prefix or suffix to indicate input [I or IN] followed by all output print records and fields should have a prefix or suffix to indicate output [O or OUT]. In the same manner, all heading records and fields should have a prefix or suffix that begins with the letter H followed by a number indicating which heading line is specified.

Module Naming Conventions and General Considerations:

a. The module name should indicate the specific function that the module is performing.

b. Code module names on a line by themselves.

c. Module names should be composed of a one-word verb followed by a two-word object.

d. A naming convention should be used to assign an appropriate 3 digit prefix to the module name, such as:

e.

Module #	Module Function
000	Mainline
025-090	Sort & Other General Items before Initialization
100-199	Initialization Processing
200-299	General Processing
300-399	End-of-Run Statistics
500-599	Input Processing
600-649	Output Processing
650-699	Headings
700-749	Page Processing
750-799	Called Programs
890-899	Detail Line Processing
999	Last Line paragraph

The above noted COBOL programming standards and documentation items should be applied to every programming course. Many students do not see the need for the rules in the first set of elementary program but then a light seems to grow brighter on why the rules are applied to the computer programs.

OUTPUT DESIGN

The output is what the user wants to view to be able to make accurate decisions for company actions. Based on the output, the programmer must determine how the data must be manipulated to produce that expected set of output. Even in the beginning classes, the author has the student design output. Whenever an output design is given to the students, a mirroring of that output has been accomplished without much problem. When the output becomes variable or designed by the student, then problems seem to happen.

The author, in trying to get students to think, has the student design the actual output for all programs in the beginning class, based on specifications provided. Initially in just telling student which fields should be on the output report, the student has to space the headings and data in a useable manner. Rules are provided on the general paper design and then students layout the headings and fields. The basic output format is presented to include company and report titles, field headings, data detail lines, total lines, and end of report indicators plus form specification notation. Based on questioning students on the first report format assignment, over seventy percent worried more on the design issue than the coding of the application. In the advanced programming course, the first problem deals with three small programs – formatted report, data output dump, and audit report. While the logic and code is as simple as the first program written in the beginning class, about seventy-five percent of the students struggle with the output design issue with special concerns about the audit report – which is noted as first record, last record, nth record(s), and some numeric totals or limitations.

At the beginning, the one-page reports provide a start to the whole design process for user expectations. The use then of multiple headings and detail lines, then selected detail lines, and multiple output design are just interations of the primary output principle but various thinking problems arise. Not all students have problems but a majority has concerns until the thinking light starts to lead the student. Integrated with the module material are concepts of deviation of the basic output to add such items as multiple output lines, page routines, and total lines.

The use of screen design is presented for another output design mode. Just as with paper output, a screen design template is discussed with a basic structure. That structure is enhanced in various programming courses depending on the various options that can be used in a normal manner. Statistically, the trend for screen design concerns has been lessening over the past five years. When students are asked why screens seem easier, the major answer is related to microcomputer use and particularly the use of word processing principles plus the relationship to use of presentation graphics in classes. A new aspect of screen design is being examined in respect to the graphical interface presented with windows and the multiple entities such as drop down list boxes which are available in Visual BASIC and also for other languages.

DATA DESIGN

For the person that thinks that output design causes some concerns on student thinking, try data design. With a systems class and programming class required for the advanced programming course, the author initially thought that students would remember basic concepts on the easy assignment of creating student-based data for the problem. Data design blows away more students that the other aspects previously noted. For the faculty member that does not agree with this, you should design your own programs for students to solve each time the programming class is presented. As noted previously, the author does not teach from a particular textbook but emphasizes content and references the textbook. Programs from previous terms seem to circulate in the academic community and thus there does not seem to be enough of the textbook problems.

The actual design of data was a function of the advanced programming course for over ten years. When the author went back to teaching the beginning class, the data design issue was tried in the beginning class with huge failure. The recovery on data design hampered the normal coverage of programming expectation in the first programming course. The particular time in which the task was attempted did not matter. Students without the first systems class really struggled with data design. Thus other avenues for data acquisition for the first programming class are now being used.

Data design for the author has come from two directions–students in the advanced programming course and a very good graduate assistant with work experiences. A third mode was used for several years but the application textbooks disappeared with the consolidation of publishers. Alan Eliason at Oregon State University had several editions of his business applications book on the market over the past twenty years and the material was excellent for showing data flow and application aspects.

The advanced programming course had students assigned applications in which file processing and updating were the main focus. All of the beginning class concepts were integrated such that the application could, with minor modification, be used in the first programming class. With the application book and various articles, students designed the file structure and then created actual data in the file-based course. Again a thinking process in the programming course. Thirty-five application areas were provided to the student with additional areas negotiated between the student and instructor. The application areas were noted in the reference index titled, Computer Literature Index, which was published quarterly.

The author also had an information systems graduate student design a new data set in 1995 after reviewing the assignments given to the classes for about seven years. The new case design include: hotel management, television programming with marketing, hardware store inventory, customer tracking for a mail order catalogue, and beer distributor. The data sets are now being revised again and some new sets designed for use in other programming courses taught by the author. On analyzing student achievement in the course, the best results from students have been with the beer distributor application–something that interests some students in spare/social moments.

If after the above design concerns, the instructor still want students to design the data, what approach can be used? The author had the least problems when the file structure was provided to the student. Given the fields and their characteristics, data can be extracted from various sources. The telephone book and various catalogues are the best sources of data content. Even when the author has used this approach, students seem to get stuck in providing realistic data after about ten to twelve records. The main success to data design seems to be related to the maturity level of the student and his/her previous work experiences. Thus, if you are teaching a traditional student, data design can be a concern. If you have older students with work experiences, the data design aspect is even fun for the student, based on student feedback.

DATA VALIDATION

Controls are obviously needed for any application no matter how processed. Errors occur in the processing of the data with the severity dependent on the dollar relationship between the error and its results. The nature of each error, from the bit to the file usage, can be traced to specific sources. The cause frequently implies the method of choice for correcting that situation. Man, in a generic sense, has always used his thinking ability coupled with business knowledge to control and edit the manual process. These same aspects must also be used in machine processing. The computer program can methodically edit and control data for applications, even to including examining character bit structures, but only in so far as human instructions are provided to the machine.

The organization should be examining all data input/entry within every application such that a minimization of errors affects the monetary structure of the organization. Programmers should be implementing general edit techniques in all application areas. Surveying the normal instructional procedures by which a beginning programmer is taught data validation programming and processing has given some concern. Changes to data validation appears to be happening in those organizations, which emphasize interactive use of data.

Some languages have added validation keywords to the language structure to aid programming. The Paradox package allows validation of fields with limits (high and low) and the BASIC language has built-in validation of numeric data for numeric fields. Even the graphical client/server application development tool of PowerBuilder has data validation rules that can be coded in the Database painter or the DataWindow painter. The COBOL 97 standard should have a new verb called VALIDATE, which will allow the programmer to check the field without writing several lines of code. Many languages, such as COBOL, FORTRAN, C++, and C, provide for data validation by the "brute force" mode of checking fields or character by character into a buffer mode. While the data validation techniques seem to be taught in many academic programs and business training settings, what is taught and what is implemented seem to differ.

Thirty businesses in one geographic area were analyzed using a validation technique matrix (which is shown in the appendix). Only twenty-two of the businesses were using some technique. Twelve businesses were totally validating data as entered into the system before processing. One major financial institution did not validate any data but expected the data entry people not make mistakes. The absence of validation was treated very lightly. The comment from the controller was that, "no errors have occurred which have been financially adverse to the company and the insurance firm for the organization would handle any losses". Based on the survey, twenty-seven firms decided to re-evaluate their data validation process. The author spent two working days with three companies to examine validation. In the stay, data errors, which were accepted by the system ranged from one error for 500 fields, entered to three errors in 120 fields in another firm. Thus firms which validate data with the software still can allow an error to be entered into the system. No system is totally fool proof in data validation. Programming code was examined in all cases to determine how errors were caught and how errors were able to get into the system. Only with extensive testing on the part of both the programming staff and the user community can errors be kept to an absolute minimum. Those errors, which still were able to get into the system, were not normal entities entered into the application but some data items, which we were trying to input to get the system to fail.

Many programming-related materials have tended to minimize the aspects of data validation to concentrate on other programming specific concepts. The current business-oriented computer curricula of DPMA and ACM [and even the new proposed joint curriculum between ACM, DPMA, and AIS] implies the need for data validations but seems to treat the concept as learned in the academic environment and reinforced in training programs. Most programming-oriented training seems to imply the need for data validation but expects the programmer trainee to know what should be done. Data validation and other controls are essential for the preventative medicine aspects of information processing. When educators are teaching the programming sequence, bad data must be used to alert the student to the real world rather than just concentrating on mirroring the output.

REUSABLE CODE

Reusable code is the newest student issue. The original program coding and subsequent re-coding of revisions is being done less but a code library must be present for the reuse issue to be used properly. The use of the COBOL COPY verb is discussed during the lecture material on formatting output for the second programming assignment. The notation that file structures are provided by the data base administrator and then copied into the program rather than being entered for each program by the programmer is emphasized. While not required to be used in that second assignment, over eighty percent of the students take the hint to use the COPY verb to bring in the file description. The same copying concept is noted in the third assignment with constants, page controls, report title, and end-of-report expectations. Again, the use of the copy verb is used by about fifty percent of the students. The author relates his experience in designing label producing programs with one to five up labels and the coding issue. Students then design a label program with these principles in mind. The program is then exchanged with other classmates to produce a class-based label program, which can be used in other assignments.

As noted earlier in the article, a set of generic programs is used in the lectures on concepts. A generic COBOL program is initially presented to show the parts to the program and the relationship of reserved word and programmer-supplied data names. A series of programs then use that generic code to present the course concepts of data dumping, format report, calculations, page insertions, conditional testing, control breaks, sorting, multiple page breaks, tables (internal and external), and screens. Those programs thus become the COBOL library for students to use and modify. While that set is available, many students still code each program from scratch. Modification are being made to the course such that a student will have to use selected programs from this generic library to complete assignments in a timely manner.

In teaching home page design, students are given a generic structure for a resume and then adapt that code to their setting. Many students search the Internet for selected backgrounds, graphics, and page formats to design pages for themselves. That correlation to reusable code is understood by students more than as presented in the normal programming course, but the point of using and re-using code for whatever language is being done more. A fine line is presented in the re-using concept and copying code between students for assignments.

With the reduction of programmers and the use of design tools, the need for original code will continue to decrease but only to the extent that the software library grows with examples of the coding procedures. The code libraries for Pascal, C, C++, and Visual BASIC continue to grow in the shareware area but little has been provided for the COBOL language.

CONCLUSION

While emphasizing the above six topics will not guarantee a good programmer, the author has received much positive feedback from local area companies and former students who have been through the process. The initial "survival" parties have disappeared but the concepts are continually asked in the interview process. While the programming topics have lessened, based on the changing nature of the information system student product, the carryover of these principles are emphasized in the data base, data communication, and systems courses. Using the above items does put more pressure on both the student and the instructor.

Thinking aspects are not just one direction. In programming, the thinking process is two way and should be made as interesting as possible for both the faculty member and the students enduring the process of coding in the variety of languages taught in the academic setting. The first experience of the author using computers was almost thirty years ago as a college senior in a traditional business computer concept course, which included FORTRAN programming. That spark led to further courses in graduate school and eventually teaching the material many times during the last quarter century. In many ways, the computer programming material reminds the author of the first college accounting course taught. The senior faculty members helped me get organized as I was taking over for another faculty member who became ill. The senior accountant told me to remember that the concepts stay the same over time plus will lessen in importance but thinking will always provide the challenge.

Note: For a copy of the diskette with sample programs, documentation standards, and PowerPoint slides, e-mail the author for reply with a compressed file attachment.

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TEACHING OOA: ISSUES AND CHALLENGES

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This paper presents the argument that object analysis (OOA) is rapidly becoming an important systems analysis methodology and that current systems analysis and design courses should present OOA. However, because of the embryonic nature and rapidly changing content of OOA, instructors are faced with special challenges when designing OOA curriculum. This paper, based on our research and teaching in this area identifes several of these issues and challenges and makes recommendations and suggestions for meeting these challenges. Specifically we address the issues of: How much of the content of class should be devoted to OOA; How the sequence of material should be organized; and whether one or more specific methodologies should be taught. Further, we address the challenges of teaching these new concepts and review the limitations posed by conflicting terminologies and notation.

INTRODUCTION

This paper will report on our effort to teach objected oriented analysis techniques and methodologies in our graduate level MIS system design course. Since many universities are currently seeking to include these object oriented (OO) concepts and methodologies in their curriculums, we believe that it is important to share our experiences with teaching OO methodologies in our system design course. The increasing use of OO concepts in all aspects of IS and IT has made knowledge of these concepts imperative for the IS professional (Pancake, 1995). Recent literature suggests that OO concepts, techniques, and methodologies will play an increased role in the design, development and implementation of organizational ISs and that analysts, designers and others should have familiarity with these concepts (Lewis, 1996; Vessey & Conger, 1994a; Vessey & Conger, 1994b). This paper will address some of the major issues and challenges presented in designing a system design course based on OO concepts and will address some of the pedagogical issues of teaching OO concepts. In addition, we plan to make recommendations concerning how these issues and challenges can be met.

BACKGROUND

The system design course taught at our university is a required course for our graduate MIS students. The course, which we teach at the 600 level, is expected to be taken by the students at the beginning of their second year of graduate study. However, students with IS backgrounds and/or system development experience may take the course earlier in their studies. Many of our students are working professionals who are taking the MIS program for career advancement within the IS field or for career transition to the IS field. Most of our students were business majors as undergraduates but a significant percentage were computer science majors. Although an understanding of a programming language is required for admission to our MIS graduate program, most of our students have minimal programming skills. Very few students have any knowledge of an object oriented programming language.

The primary focus of the system design course has been on analysis and logical design of information and software systems. Although the effect of physical implementation issues on system performance are addressed in the course, physical or low level design issues are not a primary focus of the course. Three years ago the system design course was taught strictly as a structured analysis and design course. At that point, the course was taught primarily as a structured methodology course. Scant attention was given to completing paradigms of development or to the conceptual foundations of the various development methodologies.

However, since that time the system design course has gradually developed into a course with a significant emphasis on object-oriented concepts and methodologies. It is that experience on which the recommendations presented in this paper are based.

ISSUES

During this transition of our system design course, several key issues have arisen concerning the concepts and topics presented. In addition, certain challenges are inherently faced when new topics and concepts are introduced into any course. Once the decision has been made to include OO concepts in a system design course, several key ^{3}content^2 issues must be addressed:

- How much of the course should be devoted to OO concepts ?
- Should the OO concepts and methodologies be interleaved with structured concepts or should the material be presented sequentially ?
- Should a specific OO methodology be presented in depth or should the OO methodologies be surveyed ?

Over the past three years we have taken a number of approaches to each of the above issues and consequently see some merit to each approach used.

AMOUNT OF TIME DEVOTED TO OO CONCEPTS

Given the current course content in most analysis and design courses taught in business schools, the addition of ^{3}new^2 OO material presents complicated time management problems for the instructor designing the course. However, the need to maintain currency in the course and to prepare students for practices in industry require that this new material be added. Many textbook authors have recognized the need to include this material and have added OO material to their texts (Dewitz, 1996; Pressman, 1996; Whitten, Bentley & Barlow, 1994). However, the amount of time devoted to this new material should depend on the instructors perception of its value and the overall learning objectives of the course.

Our recommendation is that at least 30 % of the course be devoted to the OO concepts for courses that follow standard analysis and design formats. Devoting less time to this material often presents difficulty in covering most of the advanced concepts (i.e., object interaction diagrams, object life-cycles, etc.) that are needed to present a good conceptual overview of the capability and limitations of the OO approach. Given the allocation of four weeks in a typical analysis and design course the following sequence of topics could be covered in some detail.

Week 1: Introduction to OO concepts

Objects, Classes, Inheritance, Operations and Behavior, polymorphism, encapsulation

Overview of advantages and disadvantages of OO approach

Week 2: Modeling with OO Concepts

Introduction of OO models;

Structural Modeling (object models)

Dynamic and Behavioral Modeling (functional modeling, object interaction diagrams, use cases, object life cycles)

Week 3: OOAD Methodologies

Overview of OOAD methodologies

Coad & Yourdon (Coad & Yourdon, 1991a; Coad & Yourdon, 1991b)

Booch (Booch, 1994)

OMT (Rumbaugh, Blaha, Premerlani, Eddy & Lorensen, 1991)

Week 4: Case Study

Complete implementation of OOAD with a particular example (Coad, North & Mayfield, 1995)

Unless the OO analysis and design topics are covered in a separate ^{3}advanced^2 class we do not recommend that less than four weeks be spend on the above topics. The ^{3}paradigm^2 shift of OO is often difficult for students to absorb in less time. The disadvantage of using more time for coverage of these concepts is that often other important topics are often neglected. Given that most of the industry is still using the traditional structured approach to systems analysis and design, we feel that it is important that these topics be covered as well.

PRESENTATION OF MATERIAL

Basically we have found that organizing the OO sequence of material into a separate topic has worked better for us than interleaving the material throughout the course. However, we can see some important advantages with a sequencing format that interleaves OO material with the structured approach. Dewitz in her recent textbook: System Analysis and Design and the Transition to Objects does a good job of integrating OO concepts with structured analysis and design concepts. The advantage of this approach is that similar examples can be used with both approaches and that the similarities between the approaches can be illustrated within the same context. For example, the concepts and notation of an entity-relationship diagram can be used to introduce the basic object model which shows structural relationships between system objects. However, the disadvantage of this approach is that it fails to address the necessary paradigm shift of OO. Students exposed to this presentation sequence often fail to appreciate the real power of OO techniques.

SURVEY OF METHODOLOGIES OR JUST ONE ?

OO methodologies are still relatively new and consequently many different OO approaches have been proposed and developed (de Champeaux & Fare, 1992; Eckert & Golder, 1994; Hutt, 1994). A recent survey of the OO literature identified over 27 different OOAD methodologies (Strouse, 1995). Despite the effort of OMG to promote some standards for OOAD, new methodologies base on different concepts and notation are continuing to be developed. Given the chaotic nature and rapid development of OOAD, it may be a disservice to students to focus exclusively on just one methodology. Our recommendation would be to survey several of the more prominent OOA methodologies. In our course we typically use the Rumbaugh¹s OMT, Booch, and Odell & Martin (Booch, 1994; Martin & Odell, 1992; Rumbaugh et al., 1991). However, we have also used Embley, Coad & Yourdon and Jacobson methodologies (Coad & Yourdon, 1991a; Coad & Yourdon, 1991b; Embley, Kurtz & Woodfield, 1992; Jacobson, 1993). Our general impression is that the students typically find the Coad & Yourdon methodology easiest to understand; however, we feel that its informality may limit its adoption in industry.

The disadvantage of surveying several approaches vis a vis a complete treatment of one approach is handling the different notation and jargon. Students can easily get confused with the different terms and models associated with each approach. Our approach generally has been to introduce the basic modeling concepts in a relatively methodologically independent way and then to show the various implementations of the basic concept being modeled. For example, modeling structure is essential in analysis and design and most OOA approaches use some form of an ³object model² to show most aspects of system structure. Specifically, we might show an entity relationship diagram as a example of a structural model and then show how an object model uses similar concepts to model structure. Typically we would start with a relatively easy model notation like Coad and Yourdon¹s and then move to a more complicated and robust notation like Embley¹s.

OO CHALLENGES

Despite the widespread interest in OO concepts and relatively recent publication of many new OO methodologies, many of the OO concepts as they are applied to analysis and high level design are relatively informal and fluid (Embley, Jackson & Woodfield, 1995; Hutt, 1994). Compounding this problem is the confusing and sometimes conflicting terminology that has emerged from the OO methodology competition (Monarchi & Puhr, 1992). This confusion can be frustrating to an instructor seeking to organize class material that presents the OO concepts in a relatively straightforward way. Teachers who want to teach OO concepts for analysis and design should be aware of the following pedagogical issues:

- Although the basic concepts of object orientation are relatively agreed on, the implementation of those ideas for analysis and design differs between OO methodologies (Synder, 1993).

- The modeling of system behavior within the OO paradigm is more problematic than the modeling of system structure (Iivari, 1995).
- OO methodologies generally require expertise in several modeling techniques (i.e.., use case, object life cycles, object interaction diagrams, etc.) that may differ between methodologies (Yourdon, Whitehead, Thomann, Oppel & Neverman, 1995).

DIFFERENT IMPLEMENTATIONS

As mention earlier, the use of OO concepts for the analysis and design phases of system design are relatively new and are still under development. Unlike object oriented concepts in object oriented programming languages, the application of the OO concepts to analysis and design is usually problematic and can be interpreted in numerous ways; consequently, different authors have implemented the OO concepts in different ways in their methodologies. Thus in many cases, the same terminology is used to represent different concepts and different terminologies are used to represent the same concepts. New terms are often introduced for old concepts in an effort to spruce up old ideas and create a proprietary vocabulary. Even the notational symbols used in the various methodologies are used to enhance the distinctiveness of the methodology and give proprietary rights to the progenitor; consequently, similar symbols (and terms) are often used to represent different concepts and different symbols are used to represent the same concepts (Strouse, 1995). However, instructors should not be too discouraged by this type of confusion since it has historically effected most disciplines. (Even the ³stately² mathematics had its notional wars such as the difference of calculus notation between Newton and Leibniz). It does require, however, that instructors be diligent and ³keep up² with the ever-changing vocabulary of OOA. In our course we have tried to keep the jargon to a minimum and to tailor our dialect to the background of the students.

MODELING SYSTEM BEHAVIOR

A recurrent criticism of most OOA methodologies is that they are poor at modeling system behavior (Fichman & Kemerer, 1992; Iivari, 1995). Critics have argued that most OOA approaches are poor at providing the necessary models to completely describe system functionality and behavior. In most cases, OOA methodologies use some form of state transition diagrams (STD) to model system behavior (e.g., the dynamic model in OMT (Rumbaugh et al., 1991)). Although STDs can be used to effectively model system behavior, it has been our experience that functional and behavioral modeling represent the hardest concepts for students to understand and model. It is particularly difficult for students to integrate behavior or functionality that may be modeled with a STD back to the assignment of a specific operation to an individual object. In addition we have found that some students have difficulty modeling the interaction of object behaviors necessary to achieve a specific system level function. Our basic approach to teaching these concepts is to thoroughly cover the STD model and to examine the particular approaches used by specific OOA methodologies only after the student completely understands the basic concepts of events, states, transitions. etc. We have found that Martin and Odell¹s Object Behavior Analysis (OBA) (Martin & Odell, 1992) and Jacobsons¹s use cases to be good starting points for illustrating behavioral modeling (Jacobson, 1993; Jacobson, 1995). OMT¹s event traces are effective for a good introduction into object interaction diagrams (Rumbaugh et al., 1991).

MULTIPLE MODELS

All OOA methodologies require the creation of one or more models to specify the requirements for a given system. Depending on the specific system and methodology used, one or more of the following models may be needed: object model, use cases, event trances, object interaction diagrams, functional model, event schema diagram, object life cycle. In many cases, presenting too many models can be confusing to the students. We try to limit our in-depth treatment to a few models and then illustrate the more advanced concepts with extensions to the existing models. We have found use cases, object interaction diagrams and object life cycle models to be particularly useful and understandable to the students. We emphasize that in most cases the information in these models can be completely integrated into the object model in order to obtain a complete perspective of the system being modeled.

CONCLUSION

This paper has addressed some of the major issues and challenges of teaching OOA within the context of a system analysis and design course. As mentioned previously in our paper, OOA is a relatively new approach to system development and no clear dominant OOA methodology has emerged. Consequently, the ideas, terminology and notation of most OOA methodologies are changing rapidly. However, despite OOA shortcomings and limitations, many industry observers and proponents of OOA believe that OOA will eventually be as dominate as structured techniques. Thus we make the argument that object oriented methodologies and OO concepts in general should be major components of the basic analysis and design course. The difficulties of teaching OO in many instances are related to the newness of the approach and required paradigm shift. OOA, like most other things in the IS field, is changing rapidly. Consequently, this poses special challenges to the instructor wishing to incorporate these ideas into the analysis and design course. We hope that the suggestions and recommendations presented in this paper will be useful to all instructors who decide to teach OOA.

The recommendations and suggestions made in this article are based on our four years of experience of doing research and teaching object oriented analysis and design. The amount of empirical research in this field is very limited at this point and we are currently conducting several studies in this area. Future research needs to be done to validate the effectiveness of OOA and to evaluate the effectiveness of techniques for teaching OOA.

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EVALUATING THE SKILLS & LEARNING EXPECTATIONS OF STUDENTS ENROLLED IN THE INTRODUCTORY CIS COURSE

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INTRODUCTION

An interesting paradox is taking place on most college & university campuses in that there is an increasing demand for computer/information technology classes, yet the computer experience level of students enrolling in these classes appears to also be increasing. One on one discussions with students will leave you with the impression that they have already done that, been there, or seen that, in terms of technology exposure. What exactly does this mean? Are students who have prior exposure taking these classes just to "breeze" through college, or has their experience stimulated more learning desires? Perhaps the training that they have had with computers has predominantly been centered around recreational and educational software as opposed to productivity software. One student recently shared that he enrolled in the class because of his desire to become a "computer game tester", since he spent many hours playing computer games.

For those students who have been exposed to computers what exactly have they learned, how much have they learned, and where have they learned it? Regarding all students as a whole, what exactly are they looking for in these computer classes that keep filling up to capacity? Are we as educators offering them the right curriculum for the present era, or are we behind the times? Michelini and Cassidy (1995) looked at an issue similar to this when they discussed the four generations of course content in the Introductory MIS course.

Since there are many different majors taking the computer classes, and they each have different expectations and needs, would it be appropriate to customize the course to target specific groups of students? For example, is it appropriate to have one set of computer information systems courses for business students and another set for non-business students? Traditionally, the computer courses offered through the business school are targeted towards business majors with the information systems component being emphasized during the quarter. There are many students who are in these classes who are not business students and are looking primarily for computer literacy training. The study that follows was developed to find answers to some of these questions and included a survey of 595 students and a review of course catalog descriptions from 30 institutions.

BACKGROUND

This study was conducted at a regional university in the southeastern United States, with a population of approximately 14,000 students. The survey instrument was administered to a total of 595 students enrolled in sections of the Introduction to Computer Information Systems during Winter, Spring, and Summer quarters of 1996, on the first day of classes. Students are permitted to enroll in the class after taking 30 credit hours, allowing this course to be viewed as having sophomore level content, taught in the University's College of Business program. This class is required by all business majors, but it is also used as a service course for many programs on campus., since it is the only "introductory computer" course of any type offered on campus, short of taking computer programming. A typical class will have at least half of the students pursuing degrees outside of the College of Business.

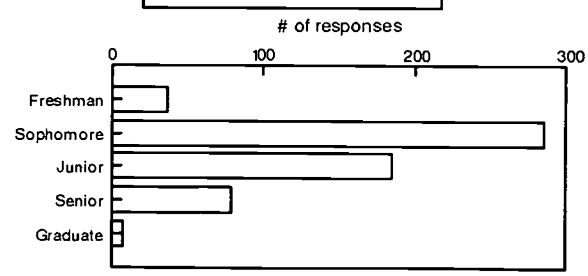
While the survey instrument charted such things as major and academic standing, the questionnaire primarily focused on two issues: knowledge the students hoped to gain from the class, and existing computer knowledge that students brought with them into the class. This study explored these two issues (areas of interest & areas of prior knowledge) and attempted to ascertain whether or not there is a significant difference between business and non-business students. The last section of the questionnaire focused on where the students learned their computer skills.

RESULTS

Overall Summary

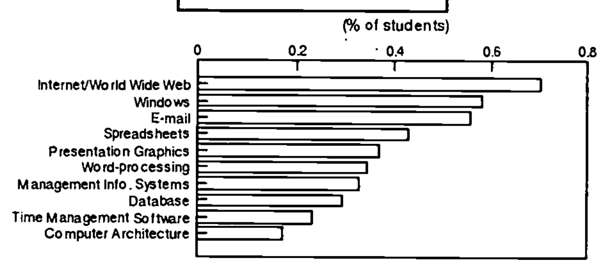
Of the 595 students who were surveyed, 265, or 45 percent were business majors. For 79 percent of the students, this was a required class, leading to the obvious conclusion that many other degree programs on campus are requiring their students to obtain some computer experience. The academic standing of students enrolled in the course is charted in Figure 1, and indicates that the majority of the students, 285 or 48 percent, are indeed sophomores, which is the intended audience for this course. Junior level students consist of the next largest group, at 185, or 31 percent. This would be consistent with expectancy since business students are required to complete this course before their junior core business classes. Freshmen made up 6.2 percent, seniors at 13.3 percent, and graduate students at 1.3 percent.

Academic Standing
Figure 1



Students were able to peruse a list of topics and indicate which ones they were interested in becoming more proficient. The responses are charted in Figure 2 by rank order. As you can see, only a few concepts that will be tackled during the quarter held the interest of a majority of students. The most popular item of interest was learning more about the Internet/World Wide Web, with 70 percent of the students selecting this topic. The least popular item of interest was learning about computer architecture at only 17 percent. This statistic supports the comment said by many students to teach them more about "how to use the computer, not how the computer works". Two other topics, Presentation Graphics, 36 percent, and Time Management Software, 23 percent, are not as desirable, perhaps because students aren't aware of their function or purpose. Many students generally enjoy working with Presentation Graphics, after completing their homework exercise, they just aren't aware of its' functions or capabilities beforehand. Learning more about word-processing is not a top priority, probably because those students who have used computers, have more than likely been exposed primarily to word-processing software.

Topics of Interest
Figure 2



On the next section of the questionnaire, students were then asked about the self- perception of their level of expertise upon entering the class. They ranked their perceived knowledge on a scale of 1 to 5, with 1 representing no prior knowledge, and 5 representing extensive knowledge. Table 1 summarizes the frequency of responses for those who circled a 1, indicating no experience with the material. In addition the table also shows the mean response for these topics.

The results clearly indicate that nearly 89 percent of the students have used word-processing software. Most, if not all, of the students should have used word-processing in their English composition course, which is a prerequisite for this computer course. Knowing this information, the 11 percent of students who have not had experience with word-processing , could be transfer students who have taken the course at another institution, students have placed out of the English course after taken a advanced placement test, or the graduate students. The results also indicate that more students are learning to use e-mail and the World Wide Web, before taking this class. Many courses across campus are incorporating this element of information technology into their curriculum, which would explain why half of the students are familiar with it.

TABLE 1

PRIOR COMPUTER KNOWLEDGE ALL STUDENTS

Topics	% of those with no experience	mean response
Word-processing	11.1%	3.27
DOS/Windows	20.5%	2.65
E-mail	49.4%	2.05
Internet/WWW	46.4%	1.99
SpreadSheets	57.1%	1.78
Database	62.4%	1.64
Presentation Graphics	71.8%	1.46
Time Mgt. Software	82.9%	1.26

The last section of the survey attempted to ascertain where students obtained computer experience, assuming they had any. They could have circled one or more out of the four options available: school, home, job, and other. Table 2 summarizes the results of those students who indicated they learned their computer skills from one or more of these options. Nearly 70 percent of the students have used computers in school, but what the question did not clarify was the level of school - grade school, high school, or college? It is refreshing to see the number of students who have access to technology at home, given the demographics of the students at this particular university. Only 20 percent of the students have used computers at work, which is surprising considering the infusion of information technology into all aspects of industry, even in low-wage, service oriented jobs, which most students rely upon.

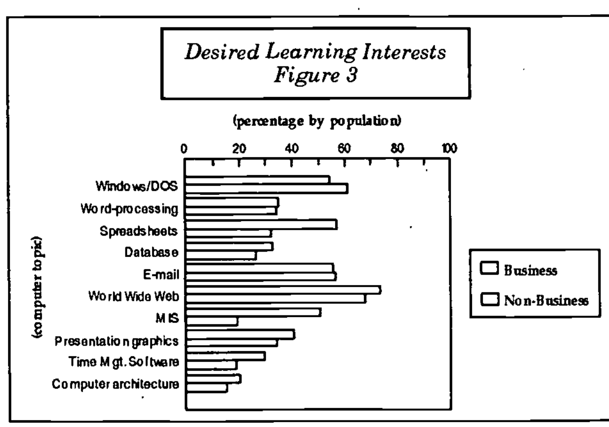
TABLE 2

WHERE DID THEY LEARN THEIR SKILLS?

	frequency	percent
School	407	68.4%
Home	242	40.7%
Job	118	19.8%
Other	15	2.5%

Differences Between Business and Non-Business Students

This section of results will focus on the differences in responses between business and non-business students, to see if there are any differences in desired expectations and skill levels. The first set of results, summarized in Figure 3 displays the percentages by population, of the desired learning interests. In all of the topics except Windows/DOS, word-processing, and e-mail, there is a higher percentage of learning desire on behalf of the business students. Learning more about word-processing and e-mail averaged out to about the same between the two populations.



Desired Learning Interests
Figure 3

The three topics of interest that business students showed a significantly higher interest in mastering included spreadsheets, time management software, and MIS. Using a 2 dimensional chi-square analysis, table 3 shows the significant differences when comparing the two groups of students at the 99 percent confidence level. Two of the three topics, spreadsheets and MIS, are of notable importance since these concepts are specifically targeted towards business students.

TABLE 3

SIGNIFICANT DIFFERENCES IN LEARNING TOPICS

concept	business	non-business	chi-square	significance
spreadsheets	56.6%	31.9%	37.28	.0000
time mgt.	29.4%	18.5%	10.03	.0066
MIS	50.6%	18.8%	69.18	.0000

Students were questioned on most of these same topics and were asked how much prior knowledge they had in these areas upon entering the class. Their responses were measured on a 5 point scale with 1 indicating no prior knowledge and 5 indicating extensive knowledge. Using a two-tail t-test, Table 4 shows the areas of significant difference at the 95 percent confidence level of the mean responses. As seen in the results, business majors showed more familiarity with five of the eight concepts than did non-business majors.

TABLE 4

SIGNIFICANT DIFFERENCES IN PRIOR KNOWLEDGE

concept	mean response of business students	mean response of non-business students	t-value	significance
Win/DOS	2.88	2.46	4.27	.000
Spreadsheets	1.92	1.67	2.76	.006
Database	1.77	1.53	2.93	.004
Time Mgt.	1.36	1.17	3.72	.000
Graphics	1.59	1.35	3.30	.001

Review of Course Catalogs

In addition to the survey results, 30 course catalogs from other institutions around the region were also examined in an attempt to discover what their course content included for the first computer course, whether it was identified as Introductory Computer Applications, Introductory MIS, or an equivalent class. The primary purpose for this was to identify if any schools were offering different courses for the various student groups, primarily business vs. non-business students. The course catalogs examined were institutions located in Alabama, Georgia, North Carolina and South Carolina, and consisted of 2 year colleges, 4 year colleges, and universities.

While it is difficult to quantify exactly what is being offered and to whom, just by looking at course descriptions, it appears that 29 of the 30 institutions introduced the use of software application literacy in the course. The Management Information Systems component was also included in 19 of the 30 school's first computer course. Seven of the institutions had multiple "introductory computer" courses, targeted for different majors. One particular institution in Georgia offered three different Introduction to Information Technology courses: one for Liberal Arts, one for Education, and one for Business majors. Another school also offered three courses: one for Business, one for Education, and one for Computer Science majors, but students could only take one of the three. Five of the schools offered courses for Business students and non-Business students at the same time. It is interesting to note that at one major university (Georgia State, 1996-98 catalog) the institution required students to have certain basic computer skills before enrolling in the College of Business, and it was the student's responsibility to obtain these skills using whatever means possible before taking any business course. The university then quantified computer skills into six basic categories, and any or all of these were used as prerequisites to the various business courses.

CONCLUSIONS

Many other educators have also looked at the issue of appropriate curriculum, and have designed their course content according to their findings. Examining the course catalogs of 30 other similar institutions in the southeastern United States revealed many different course offerings that are probably appropriate for the demographics of their student population. It is difficult to define what the best approach for course content is but it does seem that more and more students are coming in to college with computer skills, and therefore we should be able to move away from teaching some of those identical skills in college. At one point in the next decade or so, it would not be far fetched for a majority of the 4 year colleges and universities to require basic computer skills as a prerequisite to entering college, just as one institution has already done.

In regards to different courses for business students and non-business students, it does not appear to be a trend in most institutions, but it is an option, particularly for those schools where a majority of the students enrolled in the class are not Business majors. Another solution is to offer all students a basic computer literacy course at the freshmen/sophomore level, and have all business students follow up with a Management Information Systems course at the junior/senior level, which is currently being suggested for this particular school. For the administration at these institutions who are concerned about the credit hours generated from this course, this solution would appear to generate more revenue since business students would be required to take both the computer literacy course and the MIS course, while still retaining all the other students in the computer literacy course.

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PLANNING FOR ACADEMIC COMPUTING LABORATORIES: HAVES, HAVE NOTS, AND STUDENT USES OF INFORMATION TECHNOLOGY

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The researchers investigated the intensity of computer lab use by a broad representation of students at their university. The purpose was to ascertain adequacy of computer laboratory hardware, software, and hours of access. Additionally, the researchers needed to answer a social policy question, and wished to determine who was making most use of the labs—students who already owned personal computers, or those who did not. The results suggest some inadequacy of number of computers and of operating hours. The results also suggest that owners and non-owners used the labs with equal intensity. The University has used this research in improving instructional technology on campus.

INTRODUCTION

Information technology has become a permanent and essential component of the college experience. More and more college students and faculty have regular instructional experience with information technology-based learning activities. No longer are classroom computing experiences new or experimental. They are demanded instead. Employers demand not just literacy, but computer workplace competence. Universities must include academic computing issues in their strategic planning. Labs and classrooms must provide platforms, software, and access to support the students' experiences. Faculty and academic computing administrators are driven to seek effective solutions in this world of rapidly changing technology.

These changes do not come without cost. Hardware becomes obsolete all too soon. Some technology experiments fail. User support has not kept up with demand. In this volatile environment, academic computing has to address several difficult issues. Three that will be addressed here include:

- Hardware concerns: Are there enough machines on appropriate platforms to meet student needs?
- Software concerns: Do the labs offer appropriate software and training in its use to meet student needs?
- Access concerns: Are there sufficient operating hours to satisfy student demands?

In addition, there is a social concern. Does the increasing proportion of students with home computers reduce or increase the demands placed on the lab facilities?

These issues will be translated into the investigative questions which will be answered by analysis of survey data.

BACKGROUND

This paper describes one facet of a university's long-range planning for academic computing facilities (primarily student-oriented laboratories). This planning required the collection of data to identify student needs so that the laboratories would best meet those needs.

At the time the research was conducted (November 1995), there was no dial-in access to campus networks other than to the VAX minicomputer. There was then virtually no student use of the World Wide Web. There were 13 computer labs on campus at the time, not all equally, or at all, networked. While some of these labs were unrestricted and during their operating hours open to all students, other labs were restricted to certain groups of students or used for classroom instruction. Student e-mail accounts were not universal but were granted upon student request and upon instructor request.

The university is primarily a commuter school, with only 20% of students living on campus. Students commute primarily from seven surrounding parishes (counties). As at many other universities, many students also have part- or full-time employment.

Based upon anecdotal evidence, student concerns at that time included lack of access to labs when students needed them (nights and weekends), not enough computers with the right software on them, demand for high quality electronic mail, and lack of Internet access. The current research was specifically planned to address the issue of computer lab access.

METHODOLOGY

The primary methodology was case, in the sense that data were captured on a single campus. The methodology was survey, in that a survey instrument was designed to solicit the responses of students at that university. Data were captured by batch administration of the survey instrument in classrooms. This survey was completed in November 1995. The instrument was distributed to all students in all classes previously identified as "using computers as a significant component of the class." The range of identified classes was quite broad, including all English composition courses, all mass communication courses, all computer science courses, all engineering technology, all computer information systems courses, selected courses in management, quantitative business analysis, and other disciplines.

SPSS software was used to generate descriptive statistics, cross tabs and Chi-square analyses.

LITERATURE REVIEW

The researchers summarized the literature into four major themes: the need for long-range, strategic planning for academic computing, the issue of university supplied individual computers versus computer labs, the issue of what predicts intensity of student use, and the monetary and social costs associated with rapid technological change—misjudging the "speed of the train."

Heinrich and Williams (1994) wrote on the importance of long-range planning in constructing computer labs. They noted that "labs have to be able to execute what we need from them." They saw "... a strong need to maintain a focus on the broader, long-term goals of our laboratory environment and not to get distracted by shorter-term, less significant technological changes." Cartwright (1996 a) spoke about the campus wide-area network as the unifying factor in comprehensive information technology (IT) planning. Guskin (1996), on a topic related to planning, noted, "Faculty and administration must lead efforts to change before they become subject to pressure to change from external forces."

Academic computing laboratories have stiff competition in their bid for IT resources. The literature contains many stories about universities where PC ownership by students is required. Monaghan (1994) reported on the University of Washington initiative which gave portable computers to selected freshmen. Other students remained envious of those students with portable computers even though everyone had access to the University's computer labs. University officials were concerned that the initiative did not create equal access.

DeLoughry (1995) wrote that even at schools where students are required to own personal computers, high quality laboratories are still in demand. DeLoughry further observed that the have, have-not issue is an element in the decision of some schools to require that their students own or, more specifically, have 24-hour access to personal computers. According to those schools administrators, such a requirement serves to level the playing field between more affluent and less affluent students. The researchers believe that this only levels the playing field within a school, not among schools.

Berry and Jones (1995) have conducted research matching one theme of the current paper, that related to intensity of personal computer use by students. Student ownership of personal computers was significant in all five areas of their analysis, such as using a PC for pleasure more often, connecting to systems beyond their own more often, and using productivity packages more often. They found that student PC owners also relied less on classroom instruction to learn about new sources of information technology than those who did not own a PC. Kate (1990) found that 40% of college students said that computers were essential to their lifestyle. Kate found regional differences in PC use with southerners using computers the least.

Need for PC use may be influenced by how prepared students are for college. Cartwright (1996, c, b) says that computer lab planning needs to consider the needs of under-prepared students. A large fraction of college students nationwide need remediation in English and math. Cartwright writes that much of this remediation can take place in computer labs if they have multimedia and CD-ROM technologies.

Hancock (1995) noted social and economic inequities in high schoolers' computer use, that computer availability was not equal by social class, and that the pace of technological change makes closing the access gap nearly impossible. Wilson (1995) discussed the issues of how many computers are needed to serve a student population and issues such as 24-hour access to computer labs. He noted that administrators at various institutions have reported demand for access to computers and networks has doubled, tripled, and even quadrupled within a year's time. Wilson, quoted Green, "Nearly everyone misjudged the speed of the train."

FINDINGS

Both descriptive statistics and some Chi-square testing were used to analyze the data. Following presentation of descriptive information, specific investigative questions are addressed.

Descriptive Findings

There were 697 survey respondents. When identified by student classification, 15.2% were freshmen, 18.9% sophomores, 19.8% juniors, 38.6% seniors, and 7.5% graduate students. When identified by college, 17.6% were in the academic college of arts and sciences, 37.6% in business administration, 6.3% in education, 36.7% in life sciences and technology, and 1.7% other. Over four-fifths (80.3%) of respondents were seeking a four-year degree. Others were seeking graduate degrees, associate degrees, or no degree at all. Sixty different degree programs—almost all offered by the University--were represented in the data.

Slightly over one half (50.1%) of all respondents indicated that they had a home computer they could use for class work; 49.2% percent indicated they did not have such a computer; .7% did not answer the question.

Of the software tools used by respondents, word processing was the most frequently reported (83%). Second most commonly used was spreadsheet software, followed by electronic mail, database managers, and presentation graphics. (In fall of 1995, Netscape access was not available, and accounts for Gopher and e-mail access were limited.) Specifics are shown in the list below.

- Word processing, 83%
- Spreadsheets, 32%
- Electronic mail, 29%
- Database managers, 25%
- Presentation graphics, 19%

- Statistical analysis, 15%
- Gopher/lynx/Netscape, 13%
- All others identified by less than 5%; many under 1%

These usage rates track very well with employer rankings of demanded software skills as reported by Davis (1997).

Investigative Questions

Five investigative questions are answered by a combination of traditional hypothesis tests and descriptive statistics. The findings below relate to differences among various sub-populations (student class, student college, and personal computer ownership) of users of the university computing labs compared to their usage patterns and demands for greater services. These data do not address the quality of work done with the lab computers or the productivity of students using these computers.

The researchers designed the experiment to measure the laboratory usage (how much, what variety, and at what hours) by students in different colleges and classifications. The researchers' interest is whether these usage rates are (1) independent of personal computer ownership, or (2) dependent on personal computer ownership. For this level of testing, the Chi-square test of independence is appropriate. The researchers used alpha = 0.10 as the threshold of significance.

The following hypotheses illustrate this example.

Ho: Student use of labs is independent of personal computer ownership.

Ha: Student use of labs is dependent on personal computer ownership.

The Chi-square test of independence will not reveal whether personal computer ownership results in more or less usage of the labs. Chi-square only shows dependence of the two variables, not direction or causation. In order to test specific relationships within the Chi-square table, a standard test of equality of proportions (or means) will be used, in conjunction with the concept of minimum significant difference.

1. *Do students with home computers utilize a wider variety of campus software applications than non-owners?*

   Personal computer owners reported using an average of 2.47 applications in the university labs. Non-owners reported using 2.66 applications, only nominally larger. This difference is significant at .05. Non-owners use more applications than owners.

2. *Do students who own or have access to a home computer use the campus labs more hours than non-owners?*

   Usage hours were not significantly different between personal computer owners and non-owners. Specifically, personal computer owners did not use the lab more hours than non-owners. This is evidence that the university-provided lab is reaching its intended audience, and not exacerbating a technological "have" versus "have-not" issue.

3. *Do students in certain colleges make more use of the campus labs than students in other colleges, as measured by lab hours per week, and by number of applications used?*

   There was substantial variation in number of applications used by students in different colleges. Business students reported using 3.61 applications, arts and sciences 2.78, and life sciences and technology, 1.78. College of education students used the fewest applications, 1.64. Business students' use was more than double that of education students. The minimum significant difference is .139. All four college means depart significantly from the university mean; all four college means differ significantly from one another.

   There was a smaller difference regarding hours of lab use by students in different academic colleges. Arts and sciences was first (4.77 hours); education was last (3.31 hours). The extreme values were relatively closer together than when considering number of applications used. The minimum significant difference in this case is 0.193 hours. Only the business administration mean is not significantly different from the university mean. Each college mean is significantly different from all other colleges.

4. *Do students in different colleges and classifications experience bottlenecks at certain times?* The students were asked to indicate times "you needed access to a computer lab for academic work and access was either not available or you had to wait more than 15 minutes for a computer."

   The issue of hours of access is reported descriptively, not by hypothesis testing. Approximately one third (31.4%) of all respondents identified 8 a.m. to noon as a lab resource bottleneck. The afternoon time slot, noon to 4:30 p.m., was reported a bottleneck by 26.5% of respondents. Early evening, 4:30 - 8:30, was a bottleneck for 22.8% of respondents. This time period was labeled a bottleneck by only 7.5% of freshmen, but by more than one-fourth of juniors, seniors, and graduate students. Late evening, 8:30 - midnight, was identified by 18.2% of respondents as a bottleneck time (many of the campus labs were not open after 8:30 p.m., rendering access unavailable). Graduate students showed the highest percentage of need at 26.9%. In the midnight to 8 a.m. time span, only 8.3% indicated need. Since all labs were closed, this implied they had no access, not that they had to wait for a computer.

   During the morning period, business students were more apt to indicate access difficulties than students in any other college (41.6%). Computer owners reported they had access problems in the morning 28.4% of time; non-owners 34.7%. Non-owners had greater problems. This pattern is repeated in the afternoon; owners reported difficulties 19.8%; non-owners, 33.5%.

5. *Are students who have home computers more willing to pay lab fees for 24-hour access than personal computer non-owners?*

   The researchers tested for the dependence of the variable how much students would be willing to pay for 24-hour lab access on the variable computer ownership. There were three hypothetical forms of 24-hour lab access offered on the questionnaire.

   - 24-hour access for a few weeks during a semester
   - 24-hour access during the semester
   - 24-hour access year round

   Only the first of these showed a significant relationship (.06085). The responses for that case are shown in Table 1 below.

TABLE 1

PC OWNERS' AND NON-OWNERS' WILLINGNESS TO PAY LAB FEES FOR HOURS OF LAB AVAILABILITY

PC Ownership	Pay $0	Pay $1 - $5	Pay $6 - $10	Pay $11 - $15	Pay $16 - 20
Have PC	88	98	58	3	11
No PC	84	112	42	15	8

While the two variables were statistically dependent, the average amount of money offered by the personal computer owners and by the non owners was the same at $3.53. Do personal computers demand more 24-hour access than the non-owners? The answer to that is "no." Neither do personal computer owners demand less 24-hour access to labs than non-owners.

SUMMARY AND CONCLUSIONS

This research reached all students enrolled in classes "using computers as a significant part of the class." This group of 697 respondents appears to be broadly representative of university enrollment. These respondents ranked their use of software tools in virtually the same order as employers rank importance of software skills. Personal computer owners and non-owners place equal demands on university lab facilities, as measured by hours of use. Personal computer owners used fewer applications in the labs than non-owners, by a small but significant amount. Students in different colleges made substantially different demands on the labs, by applications as well as by hours used. This research did not address issues of quality of student work or student productivity in the labs.

About one-fourth of all students reported delays in access or lack of access to computer labs. Access problems were most frequent in the morning hours (8:30 - noon). Access problems declined rather smoothly throughout the day. Such declines may be natural for a commuter campus, but residential status of students was not collected. For the most part, personal computer owners and non-owners have similar opinions regarding lab fees for 24-hour access to the labs.

When one-fourth of the respondents needed access but had to wait, or found no open lab, there is serious question as to the adequacy of the number of personal computers and of operating hours of the labs. The researchers' original concern was that labs might not be serving their purpose of providing access to all students, especially those with none at home, but were being used more by personal computer owners, enlarging the computer literacy rift. The data do not support any such "perverse" use of the labs. Personal computer owners and non-owners used the labs at about the same intensity, suggesting that the lab policies were having their intended effect.

POSTSCRIPT

Since these data were gathered and analyzed, the University has continued its student-oriented push for more and better instructional technology. The University has just this semester levied a new technology fee, with student support, and has plans for making the largest unrestricted lab (in the University library) a 24-hour operation.

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A SURVEY OF NEURAL NETWORK PUBLICATIONS

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This paper is a survey of Neural Network publications published in business journals for the period ending July 1996. Its purpose is to identify and analyze trends in Neural Network research during that period. This paper shows which topics have been heavily researched, when these topics were researched, and how that research has changed over time. We found a total of 537 articles related to Neural Networks in the ABI/Inform database. Eighty nine percent of these articles were published since 1990. A majority of these papers were classified as theoretical closely followed by articles on applications of Neural Networks. Only nine percent of the articles were empirical in nature. Until 1993 there was an exponential trend in the number of articles published followed by stagnant growth thereafter. Finance topped the list in the number of articles published followed by engineering. Among the business areas, accounting had the least number of articles with a few business areas such as insurance and human resources untouched by Neural Networks.

INTRODUCTION

Artificial Neural Networks (NN) represent a relatively recent Artificial Intelligence (AI) technology. Biologically inspired, NN offer a new approach to solving ill-structured problems that are not easily solved using procedural solutions. Neural Networks are composed of elements that perform in a manner similar to that of the biological neuron. While the NN used in business applications are much simpler than the network of neurons found in the brain, the elements are organized in a way that may be related to the anatomy of the brain. NN have the ability to learn from experience, generalize from previous examples, and abstract characteristics from "fuzzy" data.

Neural Network research and applications have not been as widely reported as those of Expert Systems (ES), another better-known AI technology. A recent survey of operational ES in business found records of 440 expert systems in use, with most of the papers published since 1986 (Eom, 1996). ES applications can be found in manufacturing, banking and finance, retail, and various other industries.

Real interest in the field of NN as an approach to imitating human intelligence for the purpose of creating intelligent machines just began in the 1980s (Zahedi, 1993). Most of the reports on NN prior to this time were by researchers in academia, the government, and R & D laboratories (Vijayaraman & Osyk, 1994). Only in recent years have practitioners in the business world begun to report on applications of this technology. Our goal is to inform both academicians and practitioners about the trends in NN research and applications over the last ten years.

METHODOLOGY

We searched the ABI/Inform database to identify Neural Network related publications. ABI/Inform provides abstracts for articles from over 1000 business related publications, including professional, academic and trade journals. Abstracts of articles have been published since 1971. We first used the key words Neural and Network to search article title, subject and abstract. This search resulted in 415 articles. Then we searched for key word Neural Network* (* is used to find other word endings) which resulted in 805 articles. We further used the definition of Neural Networks to identify the papers which were related to Neural Networks. We excluded papers which casually mentioned the word Neural Networks in their title or abstract but did not focus on Neural Networks. We finally used 537 articles for this survey. This methodology is somewhat consistent with the survey conducted by Eom and Lee (1990) on Decision Support Systems and Eom (1996) on Expert Systems. We first classified the articles identified by year and application areas. Then we classified the articles by three categories: application, descriptive, and empirical. Articles under application category focused on the use of NN for a specific application. Descriptive articles focused on descriptions of NN, its benefits and costs, how to develop NN, how to implement NN, and other theoretical focuses. Empirical articles included case studies, comparisons of NN with other traditional methods like regression and econometric models, and experimentation using NN.

ANALYSIS

The objective of this research was to examine the development pattern of Neural Networks to date. To accomplish this task, we summarized the NN publications identified from the ABI/Inform database into area of application, year of publication, category of publication (application, descriptive, and empirical) and identified the journals that have published ten or more articles.

Classification of Publications by Areas and Year

The abstract of each article identified as NN related publication was thoroughly examined and classified into one of the 14 categories (Table 1). Table 1 clearly indicates the upward trend in NN publications in business related areas. There were no articles listed on NN prior to 1986. Since 1986, the number of articles on NN has steadily increased. Table 1 indicates a big in NN article publications from 1992 to 1993 (more than 100% increase) and since 1993 it has leveled off (the number of articles for 1996 is for 7 months only). Only 11% of the articles on NN were published before 1990 and the remainder between 1991 and 1996. Before 1991, most of the articles published were in non-business areas. Since 1991, publications in the areas of finance, production, marketing and other business areas have steadily increased.

Among the different areas of publication, engineering and finance each accounted for over 15% of the articles and together represented more than 33% of the total number of articles reviewed. Next, were articles on production and NN software and hardware issues with each more than 9% of the total. Medicine and accounting were at the bottom with less than 2% of the total number of articles reviewed. Other business areas such as MIS and marketing had less than 5% of publications each. There were several other areas of business such as insurance, human resources, international business, and strategic management that were not addressed by NN literature.

Classification of Publications by Category and Year

The publications were classified into three areas of focus: application, descriptive, and empirical. Application articles include description of NN applications currently in use. Descriptive articles discuss the What and How of NN technology, advantages and disadvantages, cost/benefit analysis, and implementation issues. Empirical articles include case studies, results of surveys, and articles that test NN frameworks and author's hypotheses.

Table 2 presents the breakdown of the three categories by year. Out of 537 articles reviewed, almost 50% of the articles were descriptive in nature indicating the field is still in the development stage and has not reached maturity yet. Another 41% of the publications were application oriented with only 9% of the publications falling into the empirical category. There was increase in all three categories over the last 10 years. Surprisingly, there were no publication of NN articles in the empirical category till 1991. It can be seen from this Table how research is changing over time. Yet, there is still a big gap in the empirical research of NN.

TABLE 1

CLASSIFICATION BY YEAR AND AREAS

Area	86	87	88	89	90	91	92	93	94	95	96	Total	%
Accounting						1		1	1	2	2	7	1.30
Computer Hardware/Software			1	1	2	2	5	4	4	4	4	27	5.02
Engineering			2	1	1	7	9	15	16	14	17	82	15.27
Finance			1		1	6	12	22	23	25	9	99	18.44
Forecasting					2		1	1	13	9	5	31	5.77
General applications		1	2	3	1	5	3	7	12	4	4	42	7.82
Medicine				1	1	1	1			1	1	6	1.12
MIS			1		3	2	2	3	1	4	1	17	3.17
Marketing						2	1	5	4	5	9	26	4.84
NN Software and Hardware	2		5	4	6	2	4	11	8	7	1	50	9.31
Operations													
Research				1		2	2	5	15	11	5	41	7.64
Production			1	1	2	5	6	20	5	8	3	51	9.50
Statistics							3	10	2	3	2	20	3.72
Others	1	3	3	1	6	2	3	6		11	2	38	7.08
Total	3	4	16	13	25	37	52	110	104	108	65	537	100

TABLE 2

CLASSIFICATION BY YEAR AND CATEGORY

Year	Application	Descriptive	Empirical	Total
86	2	1	0	3
87	1	3	0	4
88	9	7	0	16
89	4	9	0	13
90	8	17	0	25
91	13	22	2	37
92	24	23	5	52
93	47	54	9	110
94	40	48	16	104
95	50	47	11	108
96	25	36	4	65
TOTAL	223	267	47	537
PERCENTAGE	41.53	49.72	8.75	100

Classification of Publications by Category and Areas

The articles were also classified by category and areas to see which areas have more NN application related articles (Table 3). Finance (67%) had the maximum number of application related articles followed by engineering (50%). Whereas engineering had the highest number of descriptive articles (49%), followed by Production (60%).

The operations research and statistics areas had the maximum number of articles in the empirical category. Finance, engineering, medicine, and NN software/hardware areas had more articles published in the application category than the descriptive category. Only statistics had more articles under empirical category. Table 3 also indicates that there are more application articles published among the business areas than descriptive articles and there is a serious lack of empirical research.

TABLE 3

CLASSIFICATION
BY AREAS AND CATEGORY

	Application	Descriptive	Empirical	Total
Accounting	5	1	1	7
Computer	12	14	1	27
Engineering	41	40	1	82
Finance	67	23	9	99
Forecasting	7	18	6	31
General	15	24	3	42
Medicine	4	2	0	6
MIS	8	9	0	17
Marketing	9	17	0	26
NN Software/Hardware				
Operations	8	21	12	41
Research				
Production	17	31	3	51
Statistics	2	7	11	20
Others	0	38	0	38
TOTAL	223	267	47	537

Table 4 identifies journals that have published ten or more NN articles. There were eleven journals which published 37% of the total articles identified in this survey. Computers and Industrial Engineering had the highest number of articles published (8.38%) followed by Microprocessing & Microprogramming (6%). There were more than 100 journals and magazines that published the NN articles from 1986 to 1996. Many of the articles reviewed were published in trade journals and magazines compared to scholarly journals.

IMPLICATIONS OF NEURAL NETWORKS FOR BUSINESS

Many challenges continue to exist with respect to the design, implementation, and evaluation of neural networks in business applications. A number of decisions must be made regarding the structure of the system. One must determine the appropriate software to use, the architecture of the network, the method of learning, etc. When implementing neural networks, a number of questions must be addressed. How will the neural network application be integrated with existing systems? What type of interface is needed? Also, how will organizations evaluate the success of neural networks? More research must be done on the criteria for measuring machine intelligence. How can one measure reliability ? How can one determine the cost/benefit of neural network applications? What resources will be necessary for organizations to support and manage the development, implementation, and evaluation of new technologies?

TABLE 4

JOURNALS WITH 10 OR
MORE ARTICLES ON NN

Journals	Number of Articles
Credit Card Management	10
Computers in Industry	11
Computers and Industrial Engineering	45
Computer World	14
Computers and Operations Research	18
Decision Support Systems	14
European Journal of Operations Research	13
FutureS	22
IEEE	10
Manufacturing Systems	10
Microprocessing & Microprogramming	31
Total	**198**

As more neural networks are developed and implemented, more information will be available to answer the above questions. It is clear from our search that neural network applications are on the increase in a number of functional areas, including engineering, finance, and production/ operations management. More published information on the successes and failures of these applications, the challenges faced, and the solutions found, will continue to be very important to those practitioners interested in developing applications of their own.

IMPLICATIONS FOR FUTURE RESEARCH

Neural networks and neural network

applications will continue to be important to academicians on two fronts: research and teaching. As noted earlier, our search found that a significant number of neural network articles appeared in trade journals and magazines. From a research perspective, many opportunities exist to "fill in the gaps" in the academic literature. Empirical articles represented less than ten percent of the total articles published. For example, in the finance area, with a total of 99 articles, only nine of these were empirical in nature. Clearly, many opportunities exist to add to the body of knowledge on these topics.

A limitation of this study is that it only surveyed articles published in the ABI-INFORM database. While this database did provide a comprehensive listing of articles published in business-related periodicals, a number of sources were excluded. Many opportunities exist to expand on this study. To develop a comprehensive bibliography of neural network articles, a number of other sources should be utilized. Comprehensive databases exist in the computer science field, the medical field, and in other areas. These databases should be utilized in future research. In addition, articles published in many periodicals typically suffer from a "time lag" effect from when the information was researched to when the article was ultimately published. A comprehensive survey should include other sources including dissertation abstracts and relevant conference proceedings. These sources would undoubtedly contain more up-to-date and state-of-the-art material.

From a pedagogical point of view, articles that investigate the trends in the development and implementation of new technologies such as neural networks will continue to be important. Comprehensive lists of resources will also be very important to educators. Academicians are continually trying to bridge the gap between theory and practice. Textbooks that report on cutting edge technologies are soon outdated. Instructors frequently must rely on other outside reading assignments. Because of the dynamic nature of the field, it is important that educators remain aware of the current developments in the field, including current trends where applications are being implemented, the problems with implementation, etc.

CONCLUSIONS

This paper provided a survey of neural network publications in business journals through July 1996. A number of conclusions may be drawn from the results of this survey. First, there has been a significant increase in the number of neural network publications in recent years, presumably reflecting an increase in interest in their development and implementation. Second, publications in certain areas (such as engineering, finance and production/operations management) have exceeded the publications in many other areas. Third, the gaps in the literature indicate that many opportunities exist to report on additional research efforts in the development and application of neural networks. Finally, many opportunities appear to exist for collaborative efforts between academicians interested in theory and practitioners interested in implementation.

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AN INTERNATIONAL, CROSS-CULTURAL EXPERIENCE IN INTRODUCTORY INFORMATION SYSTEMS

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In order to provide Information System (IS) students with an instructive, hands-on exposure to internationalism, three universities on two continents collaborated in having students do team-based e-mail with virtual team-mates at the other two universities. The experience proved to be a worthwhile project, although it revealed a number of unanticipated complexities.

VALUE OF THE INTERNATIONAL EXPERIENCE

Prior to the 1990s, IS Curricula made scant mention of international issues, focusing instead on a US perspective. That the international component is an essential part of IS curricula is a fact, perhaps best illustrated by the special issue of MIS Quarterly (1995). There is evidence that educators are placing more emphasis on a global perspective.

According to one study, the developments leading the drive to increased internationalism are (1) international telecommunications, (2) trans-national data flow, (3) Internet, (4) Global enterprise networking, (5) EDI, and (6) ISO-9000 (Deans 1996). As more and more companies become international in scope, it becomes imperative for Schools of Business to join the parade. Of course, international experiences are invaluable in providing students with a well-rounded liberal education.

There are several reasons for including internationalism in IS curricula, apart from School of Business curricula. One compelling reason is that IS technologies vary worldwide. More importantly, however, is that cultures also vary, and successful information systems must be cognizant of these cultural differences. Additionally, as international companies continue to accelerate movement of employees worldwide, IS personnel can likewise expect more and more transfers to other cultural settings.

There are implications, large and small, raised by the necessity of incorporating internationalism. Should a course specific to IS/International issues be included in the curricula, or should international issues be integrated to select IS classes, or integrated across the IS curriculum? What should be the content of such courses? What methodologies are associated with the successful teaching of internationalism? How can faculty, largely untrained in internationalism, be expected to convey important precepts to students?

We have concluded an experiential exercise in resolving some of these issues. Three universities collaborated in an international e-mail experiment. In brief, we conducted a joint project in our introductory IS classes to exchange e-mail in a triadic fashion.

GOALS OF THE INTERNATIONAL EXPERIENCE

The springboard for our experiment was an exchange between students at George Washington University and a university in the Netherlands. Four students from GWU and four students from the Netherlands volunteered to participate in this exchange. The students were sophomores who were just learning to use e-mail. The objective of this exchange was to have teams write papers on emerging technologies. Each team had two students from each country. Ultimately, only one of the two groups was successful in completing the project, and the resulting paper was somewhat disappointing. The project suffered from a number of difficulties. The authors attribute the lack of success to the difficulties of going global—differences in time of the two school's terms, technical difficulties with their addresses, and to the fact that the project was volunteer (Granger and Schroeder 1994).

To overcome some of the difficulties experienced by the GWU-Netherlands project, we modified the objective of experiment. Instead of collaborating on a paper, our goal was more modest: to have students exchange biographical information. More specifically, students were instructed to send the following biographical information in phase one:

1) Student name.
2) A short (one or two sentence) description of himself or herself.
3) The student's major, and why he or she selected it.
4) Any other pertinent, interesting, or relevant data about himself or herself.

The goals of our experiment were to:

(1) Provide introductory IS students with an international experience promoting awareness of and appreciation for cultures across national borders.

(2) Provide students with a setting to practice their e-mail skills (forwarding, replying, preparing distribution lists) and to extend their experience using the Internet.

(3) Provide students with an easily achievable international objective to reduce the anxiety and fear some students have regarding computer technology.

(4) Provide the three faculty a learning experience in conducting an international joint exercise, so that in the future we might extend the scope of student communication.

SETTING UP THE EXPERIENCE

We believe the three universities in this project represent wide cultural diversity. Indiana State is a small (10,000 students), regional Midwestern University, with many students coming from small towns, and oftentimes being the first generation in their family to attend college. The introductory IS at ISU is a general education class—and must meet certain requirements in addition to the traditional IS concepts and tools. This project is useful in achieving some of those requirements.

Drake University is a small private Midwestern University. Average pre-admission test scores are quite high. In addition, the students in the participating IS class at Drake were, for the most part, pharmacy majors.

Hong Kong University is a larger university located in a large city. Few of the students were fluent in English. The students were all information systems majors.

The students at all three universities were divided into 19 teams. There were four ISU students on most of the teams, two Drake students on all of the teams, and two or three Hong Kong students on each of the teams. In phase one of the project, students from ISU e-mailed biographical data to Hong Kong, Hong Kong students e-mailed biographical data to Drake, and Drake students e-mailed ISU. Each student sent biographical data, and were expected to prepare a distribution list of the their team members at their corresponding university.

Phase two was designed to provide "Reply" experience to the students. After receiving a biography, students were expected to send a "thank you" note for the biography.

Phases three and four were intended to repeat phases one and two, except that the direction was reversed. ISU students sent to Drake; Drake, to Hong Kong; and Hong Kong to ISU.

We formulated the nineteen teams with at least two members from each school to minimize risk of individuals not receiving communication from the other universities. The more computer literate intra-school team members were encouraged to assist their less literate colleagues.

RESULTS

The seemingly simple experiment proved to have a number of unforeseen complexities. Like GWU and the Netherlands university, we found that unmatched terms was a big problem, compounded by the fact that we were coordinating three universities. Drake is on a quarter system, whereas Hong Kong and ISU are semester based. However, the quarters and semesters all had different start times. We each had a spring break scheduled during different weeks of March, especially unfortunate since the bulk of our communications were scheduled for March.

On the other hand, we experienced few technical difficulties. Virtually all students who were still attending class were able to successfully complete phase one of the project, and most completed phase two. The fact that Drake is Mac and the other two were Intel based proved not to be a problem.

By far the greatest difficulty we experienced was miscommunication among the coordinators of the project. At one of the universities, students "replied" to the incorrect university. Also, one of the universities assumed that a second class would participate in phases three and four, with the first class dropping out of the project, thus necessitating a redrawing of teams.

CONCLUSION

In spite of the difficulties, we deemed the project a worthwhile experience. International cooperation was proven to be a partially achievable goal. Anecdotal evidence from some of the students indicates that many believed the project to be a positive and enduring experience. Several students encouraged us to repeat the experiment in the future.

We believe the experience to be a useful exercise in terms of teaching students of the worldwide implications of e-mail on the Internet. We believe we succeeded in our goal of teaching our students about some cultural differences, and, perhaps more importantly, cultural similarities.

Was anything accomplished by doing this project as a three-way rather than two-way experiment? We believe it provided a more manageable and rational structure for forwarding mail. Perhaps Hong Kong students discovered that "not all Americans are alike," having the two American universities to compare. Perhaps, though, the complexities and difficulties of managing a three-way interface outweigh any of these benefits. It was a useful enough experience to encourage us to continue with similar international exercises.

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PANEL DISCUSSION

PITFALLS TO AVOID WHEN INCORPORATING ELECTRONIC TEAMS INTO COURSEWORK: A PANEL DISCUSSION

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The panel consists of IS faculty members who have utilized electronic teams in their IS courses. They have utilized a variety of different electronic team arrangements and projects and have challenged students to develop deliverables while overcoming different academic calendars, time zones, and international cultures. Since the use of electronic teams composed of students at different universities is a relatively recent phenomenon, the panelists have experienced their share of mistakes and frustrations in their attempts to provide a rewarding experience for their students. In this session, the panelists will provide an overview of pitfalls of electronic teams that they have encountered and will attempt to provide faculty members who are planning to use electronic teams with guidelines of avoiding potential pitfalls and minimizing frustrations for their students and themselves. A sampling of the pitfalls to avoid is provided below.

PITTFALLS TO AVOIDY

There are numerous potential pitfalls associated with electronic teams. Some of the potential pitfalls that IS instructors should be aware of include: unclear team leadership, ambiguity in project definition and instructor expectations, inadequate specification/division of duties among locations and group members, inconsistency in file formats and message encoding schemes, insufficient communication among locations and group members.

Unclear Team Leadership

Teams consisting of multiple members at multiple remote locations function best when there is agreement about who is in charge of making the final decisions, especially when the intergroup project demands the submission of identical deliverables at each location. Instructors should not overlook the fact that the project teams are combinations of distinct groups at the different locations. These distinct groups vary in cohesiveness, leadership, task-role definition and ability/knowledge range; each is also likely to have unique internal and external dynamics. When projects require them to collaborate with others at different locations, lack of clear team leadership can contribute to coordination problems. The potential for this to be a problem is increased when group members at each location are randomly assigned to project teams; they may have difficulty meshing with other group members at their own location as well as with project team members at other locations. If the group leadership issue is not addressed, groups at each location may perform duplicate work and squabbles over whose work is going to be submitted as the group=s deliverable may result.

To address this potential pitfall, instructors should require project teams to determine who (i.e., which group at which location) is responsible for putting deliverables in final form prior to submission. While conscientious students at each location often have valid concerns about giving up editorial control over the final content of deliverables, they should be reminded that determining who at what location is in charge of pulling all the loose ends together is essential for ensuring effective group functioning and identical submissions of deliverables. Instructors should also be aware that project group leadership may shift among locations if there are multiple deliverables (e.g., the groups at the different locations may take turns being responsible for putting deliverables in final form) or if group members at one location are dissatisfied with the quality of the deliverables being submitted to instructors.

Ambiguity in Project Definition and/or Instructor Expectations

If group members at the different locations are unclear about what the instructor(s) expects about the content of deliverables, significant variation in the quality and format of submissions is likely. It is important for instructors at the different locations to agree about what they are looking for from each project group and to clearly communicate these expectations to group members. If instructors are not reading from the same page, group members at the different locations are likely to have different perceptions of what they are required to submit.

To avoid such ambiguity, it is important for instructors at the different locations to clearly specify the same project definition and expectations to their students. This may be facilitated by having pre-specified, written descriptions of the project and each project team deliverable. Any changes made to these once the project is underway should also be communicated to all group members at all locations.

Inadequate Specification/Division of Labor Among Locations and Group Members

Unclear group leadership and ambiguity in the project definition or instructor expectations can contribute to inadequate specification/division of labor among locations. This can result in duplicate or non-essential work being performed at different locations as well as feeling that some group members (or entire locations) are not pulling their weight or contributing sufficiently.

Clear agreement about group leadership and clear project definition/instructor expectations can minimize the potential for this to be a major problem. In addition, instructors should consider structuring the tasks associated with the deliverables in a Amodular@ fashion so as to facilitate the equitable distribution of work among locations and group members. This may demand some planning and up-front work on the part of the instructors, but doing so may help to avoid social loafing among group members or entire locations. The use of peer evaluations may also help to avoid this potential problem. When group members see that their individual grade is dependent on the rating that they receive from their project teammates at all locations, they may become more concerned about making a good faith effort to contribute.

Inconsistency in File Formats and Message Encoding Schemes

To facilitate the completion of project assignments, groups at the different locations should agree about file formats and message encoding schemes. Group members at particular locations may experience considerable frustration when they receive pieces of a deliverable in an unknown or unconvertible format.

Up-front agreement about file formats can avoid these difficulties. Instructors can also assist group members at the different locations by stressing the importance of agreeing on common file formats and message encoding (e.g. MIME) and by demonstrating how to convert files to the agreed upon format prior to transmission to other locations.

Insufficient Communication Among Locations and Group Members

Communication among locations and among group members at each location is essential for project team success. This may be seen as the root cause of most of the problems and challenges faced by distributed electronic project teams. If group members don=t know what other group members are doing or which aspects of the project they are responsible for, there are likely to be flare-ups and coordination difficulties.

Instructors must ensure that there is adequate communication among group members across and within locations. Requiring groups to submit communication logs documenting communication activities may be one possible way to address this problem. Groups should be encouraged to use multiple communication channels (e-mail, chat rooms, telephone, fax) to ensure sufficient communication levels and staying on task.

A BEHAVIORAL ANALYSIS METHOD FOR ELECTRONIC COMMUNICATION ENVIRONMENTS USING A GENETIC ALGORITHM

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The purpose of this paper is to set forth an analytical method for determining and discovering a user's behavioral characteristics within an electronic mail environment based on a genetic algorithm. This analysis method consists of the following: a behavioral simulation which simulates individual use within a particular electronic mail environment model, and a process which evaluates user-behavior and selects suitable behavioral characteristics based on the simulation results. By repeating both the behavioral simulation and selection process of behavioral characteristics, we are thus able to compile a distribution-pattern of characteristic suitable to optimal 'initial stated' of particular electronic mail environments. The following two implications emerged from simulations: this analysis method can discover a distribution of user characteristics corresponding to a 'fixed' environment or 'initial state' and also reveal the wide variance in the behavioral characteristics of users. Thus, as a result, this analytical method can be seen as a more accurate way to determine both the 'cost to' and 'effectiveness of' a given system for users as a materialization factor within an electronic mail environment. Finally, this method suggests possible management criteria for effective electronic mail environments.

INTRODUCTION

It is generally thought that the effectiveness of an electronic communications system, for example E-mail and/or BBS (Bulletin Board System), changes empirically according to the number of users using the system. Even within our own BBS, operated primarily as an empirical electronic communications environment, we actually observed a dramatic enhancement of the system in accordance with an increase in the number of users who substantially and effectively utilized the system. However, in actuality, when the resultant, analyzed access log was reviewed, this "vitalization" of the electronic communications system was due in large part by the number of active users who both manipulated and analyzed large amounts of information. In other words, the effectiveness of an electronic communications environment expands not merely by the sheer number of users a system has but instead by the number of users who actively and substantially manipulate the system altogether. Also, the optimum effectiveness of a particular electronic communications system is largely determined by the user's expectation of the system, his/her application purpose and method of evaluation. Moreover, when these variables are decided by the user and coordinated with the system her or she is using, then a sort of optimal equilibrium is found between the user and electronic communications system. In this case it is surmised that the distribution of this behavior pattern, characteristic of a user's needs conforming with the system he or she is using, is directly related to the initial condition of the electronic communications environment. The purpose of this paper is to set forth an analytical method for determining and discovering a user's behavioral characteristics within an electronic communications environment.

BEHAVIORAL ANALYSIS METHOD

It is conceivable that such a method, through which simulation discovers the most suitable behavioral characteristics between a user and an electronic communications system, could determine which 'initial state (condition)' is most effective within a given electronic communications system. However, in order to determine the optimal behavioral characteristics suitable to a particular electronic communications environment, many 'initial states' must be evaluated by this analytical method. Therefore, an analysis using both behavior simulation along with genetic algorithm (GA) was used to extract favorable behavioral characteristics for particular electronic environments.

Behavioral Simulation

FIGURE 1

A MODEL OF ELECTRONIC COMMUNICATION ENVIRONMENT

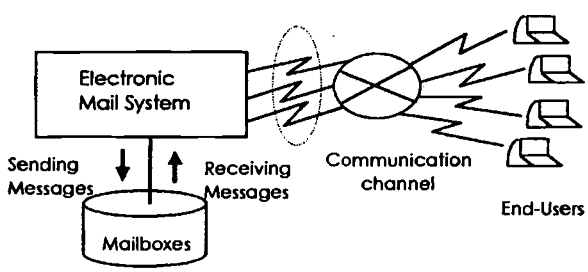


Figure 1 shows the electronic communication environment model that was hypothesized in this simulation. In this environment users can send and receive only electronic mail addressed to them through a simplified environment without such functions as a bulletin board system and global message sending. Messages sent from some users are saved in mailboxes, whereas the simulation deleted from some other users' mailboxes received messages. Other characteristics for an electronic mail system in this simplified environment were modeled as follows:

1) User access to the system through the connection channels,
2) Some users can access the system simultaneously but are limited to the channel number,
3) Although the system keeps 'sent' messages, the receiver of the messages is not alerted in any special manner,
4) The 'receivability' of the messages is a probability determined by the ratio of the mailboxed messages to the total number of users, and
5) continuous access time as defined by a unit of time in this simulation.

This model is not realistic because it employs electronic mail which suggests a probably receiving process without addressing a designated receiver. However, the purpose of this simulation is to evaluate suitability of characteristics of user-behavior according to usability of the system and 'receivability' of messages. Therefore, the simulation only hypothesizes a probable receiving process.

Evaluation and Selection

Equation (1) calculates the evaluated value of user's behavior using both utility and costs for the user. "E" represents the utility felt by user when the purpose of transmitting messages was achieved. "F" represents the cost for communication refusal when all channels are busy. "G" represents the cost variable for connecting with no new messages. Evaluated value "T" of each above characteristic of behavior was defined as the remaining value of subtracting the total cost from the utility according to the system usage, divided by the simulating period of time = "m".

$$T = \frac{E - F - G}{m} \qquad (1)$$

It can be considered that the user's behavior characteristic more readily "fits" the environment as "T" is increases. By using genetic algorithms along with "T" values, successive user-behavior characteristics were determined for the next generation. Finally, as the newly 'discovered' user-behavior characteristics are distributed, a so-enhanced simulation for the next generation is regenerated.

SIMULATION

An experiment program to analyze characteristic of user's behavior in electronic mail system for based on this analysis method was installed on unix worksation using gnu c++. In this experiment the electronic mail system has only one communication channel and holds no message at all at the initial state. It was implemented with the hereditary characteristics such as the intersection occurrence probability between genes is 80%, the mutation occurrence where probability is 15%. Unit time of this simulation is 10 minutes, it means that a day has 144 units. Accessing time was fixed at 1 unit of time per correspondence attempt. One "generation" was determined after a 10-day simulating time. An electronic mail system is hypothesized that utilizes the electronic communication environment continuously for 10 days. Therefore, held messages are not reset everyday.

Usually, in Japan, users achieve "optimal access" to such system after nightfall. However, the 'hypothesized' simulation attempts to equally distribute "use" per hour. In such condition it takes 20 minutes to proceed a simulate 3000 'generations' with 150 users.

FIGURE 2

THE USER-RATIOS OF EACH USER CHARACTERISTIC TO 3000 GENERATIONS WITH 150 USERS

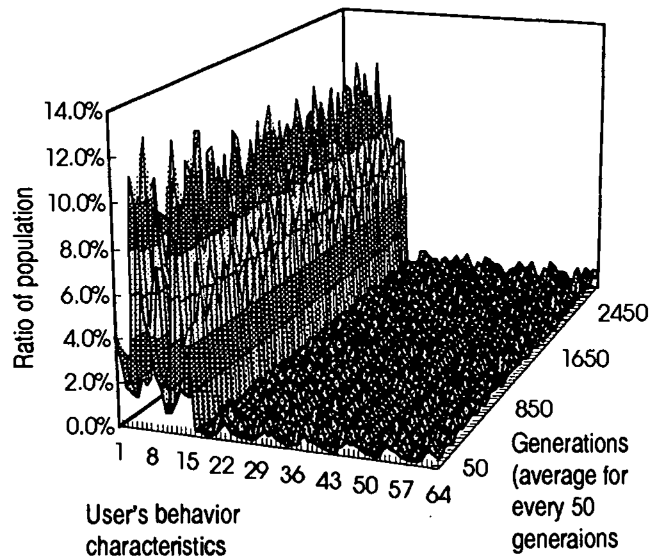


TABLE 1

ID NUMBER OF USER'S BEHAVIORAL CHARACTERISTICS

Message sending ratio	0.0 ~ 1.0 (less than 1.0) Type A								1.0 ~ 2.0 (less than 2.0) Type B							
Evaluation factor for system	A				B				A				B			
Evaluation factor for disconnection	A		B		A		B		A		B		A		B	
Evaluation factor for no receiving mail	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Accessing ratio (per day)																
0.00 ~ 0.75	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.75 ~ 1.50	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1.50 ~ 2.25	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
2.25 ~ 3.00	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64

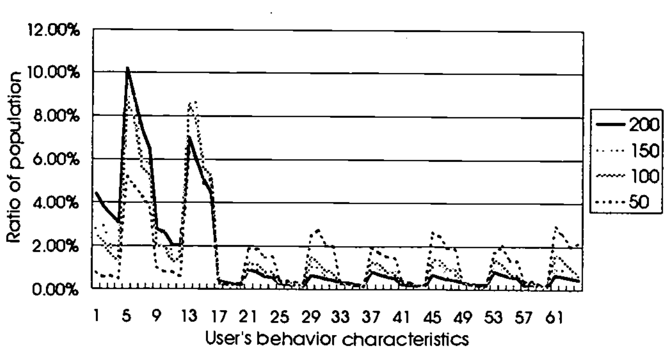
EVALUATIONS

Figure 2 shows a result of this simulation: a plotted series of the user-ratios of each user characteristic to 3000 generations for every 50 generations in an environment with 150 users. A series of user characteristic numbers appears in figure 2, and a series of ID numbers which are illustrated in table 1. In the case of figure 2, the ratio of population where the utilization frequency is less than 0.75, these ID numbers are from 1 to 16, is higher than others. In the series of the ID numbers the populations at ID No.5~8 and No.13~16 are even higher than other totals. These higher figures suggest many users who favorably evaluated their 'access to' the e-mail system.

Evaluated next were the changes in the characteristics' distribution of user's behavior related to changes in total user number. As shown in figure 2, the characteristic distribution of user's behavior does not change largely even if generation is changed after the outline was decided at once. So the outline can be produced by taking an average of user characteristic distribution. By using this 'averaging' procedure, figure 3 summarizes outlines of user-characteristic distribution to 500 generations into one graph where the total user number was 50, 100, 150, 200 in each simulation. Fundamentally, all of the users' characteristic related to the total user number, and the population ratio, where the utilization frequency is less than 0.75, ware higher than other correlations.

FIGURE 3

THE AVERAGE USER-RATIOS OF EACH USER CHARACTERISTIC TO 500 GENERATIONS



These results show that this analysis method can highlight the distribution patterns of characteristics of user's behavior from the electronic communication environment he or she is in. In particular, the empirical communication environment we have examined is the same as the setting of this simulation. In our environment there is only one communication channel and the substantial users are less than 50 people. As a result, this method clarified 'user-utility' from the system and a cost to the user which are important factors in both the realization and management of an electronic communication environment.

CONCLUSION

This paper shows just what this analytical method is capable of with regards to simulation implementation and results achieved. The following two implications emerged from simulations: this analysis method can discover a distribution of user characteristics corresponding to the condition or 'initial state' when the communication environment is 'fixed'; where behavioral characteristics of users exhibited wide variance. Thus, as a result, this analytical method can be seen as a more accurate way to determine both the 'cost to' and 'effectiveness of' a given system for users as a materialization factor within an electronic communications environment. Finally, this method can also suggest both of building and management criteria for effective communication environments.

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NOTES ON THE SYNTHESIS OF THE FIRM

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It is increasingly difficult to design computer systems with traditional systems analysis or computer supported cooperative work. (Bowers 1994) This abstract describes a methodology for information system and organisation development that breaks the work of the firm into 7 basic elements and shows how these elements are assembled. The approach has been applied in financial services, manufacturing, computing and broadcasting. The models have helped staff to articulate their customer's expectations, the goals that the business shares with customers and stakeholders and the organisation and systems required to support their work.

The methodology has potential for teaching business analysis. By building small models students learn how to communicate across disciplines, how to understand the relationship between the firm and its customers and suppliers and how to organise work and specify software applets and services.

The models admit three kinds of interpretation. For those with no background in MIS or computer science the drawing provides a graphical representation of the structure of the work of a firm and its key workflows. This can serve as a common language across the disciplines within a business.

For MIS students, familiar with a mechanistic application of transaction cost economics (Ciborra 1983, Malone 1987), the approach provides a useful antidote to the weakness that Coase identified in his theory - that an overt concentration on negotiation neglects how the functions of the firm relate to one another. (Coase 1993)

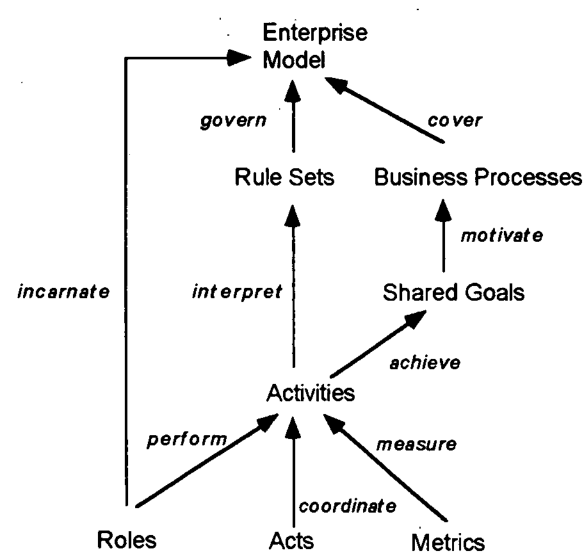
Computer scientists and programmers familiar with modern object languages and middleware (such as Java and Corba) are able to give the model an operational semantics that specifies the programming interfaces of distributed services. Software and organisation construction rules follow the structure of the diagrams in accordance with architectural best practice. (Benson 1992, Alexander 1964)

SEVEN CONCEPTS

Figure 1 is a concept fan that shows how the ideas used to describe the structure and behaviour of a firm support each other.

FIGURE 1

CONCEPT FAN FOR CAPTURING BUSINESS REQUIREMENTS



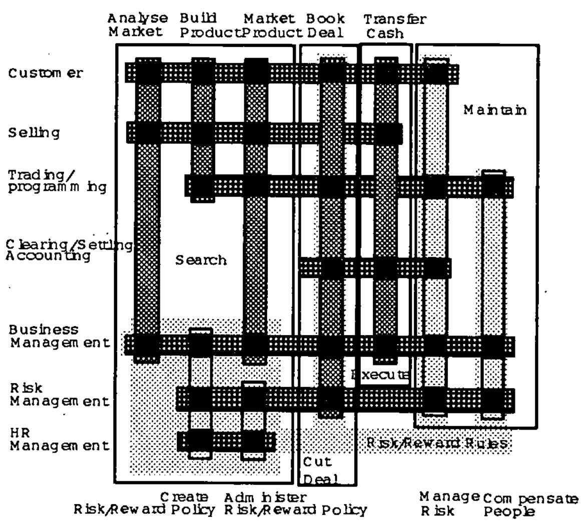
The firm is represented as a collection of *roles* that communicate to perform the work of the enterprise. Work is aggregated into *business processes*. governed by a family of business *rule sets*. Rules affect the culture and behaviour of people and the way decision making occurs in the business.

The Enterprise Model captures only investment or value generating *activities* that support goals. Some activities interpret rules, either to achieve *goals* shared with customers or stakeholders or to modify the rules in the light of experience. Other activities are distinguished by coordinating the work and moving it on. These are called workflow *acts*, explicit or implict utterances such as guaranteeing, forgetting or returning tickets to a trader.

An important part of the training of business analysts is to introduce the recognition and classification of workflow acts in terms of standard conversational moves such as promise, counter-offer or reject (Medina-Mora et al, 1992). All activities may have associated performance *metrics* - such as activity cost, or revenue.

FIGURE 2

PART OF AN ENTERPRISE MODEL FOR A FOREIGN EXCHANGE BUSINESS



VISUALISING STRUCTURE

Some of the graphical conventions are shown in Figure 2 - a fragment of the Model for a Foreign Exchange business. The drawing is constructed by first listing the interactions that make up the customer life cycle and placing these over a grid of business processes representing the transaction cost perspective on a business exchange: search and gain information, bargain and decide, police and enforce contract. (Dahlman 1979)

A completed Enterprise Model brackets transactional contracts (exchanges that have a fixed duration, price and conditions of satisfaction) within the context of a contractual relationship (an open ended state such as marriage).

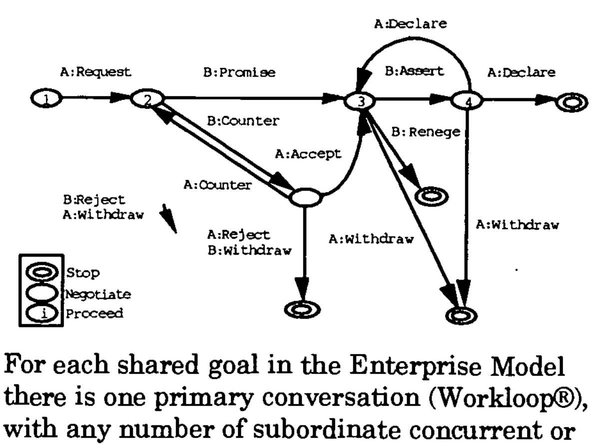
Customer goals are drawn as columns hanging the top of the drawing, stakeholder goals grow from the bottom. Logical roles are shown as rows ordered vertically according to their distance from the customer. Activities are denoted by highlighting intersections. Rule sets are placed in the background. (Sybase 1995)

VISUALISING BEHAVIOUR

The key to interaction between logical roles is the Conversation for Action (Winograd, Flores 1986). This is shown below in equivalent state transition (Figure 3) and Action Workloop® forms (Figure 4). (Medina-Mora et al, 1992) In both diagrams arcs are labelled by workflow acts. Numbered states mark the initiation of a phase of the conversation: request (1), negotiation (2), performance (3) and accept-complete (4). Four of the remaining states are terminal, they mark exit from the dialogue. The remaining state, negotiate, marks the situation in which the conditions of satisfaction *(CoS)* of the conversation are not yet completely resolved.

FIGURE 3

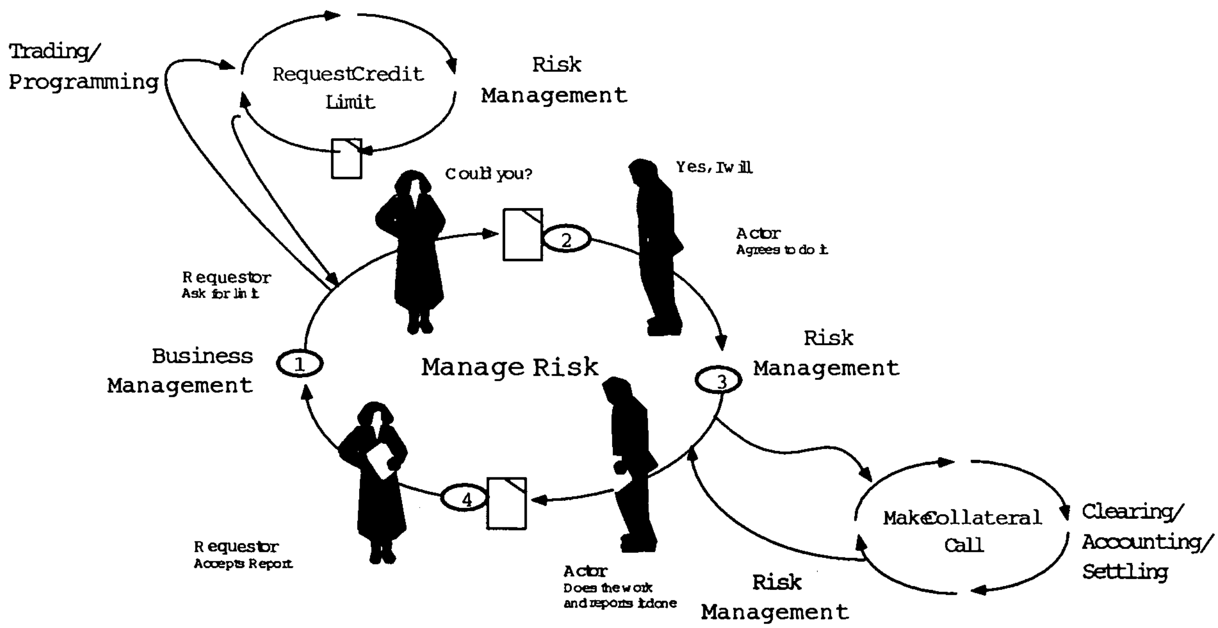
CONVERSATION STATE TRANSITION DIAGRAM FOR THE CONVERSATION FOR ACTION (WINOGRAD, FLORES 1986)



For each shared goal in the Enterprise Model there is one primary conversation (Workloop®), with any number of subordinate concurrent or sequential conversations. These are represented graphically as smaller loops linked by directed arcs to the primary workloop.

FIGURE 4

A COMPOUND ACTION WORKLOOP® CORRESPONDING TO THE GOAL MANAGE RISK



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A CONCEPTUAL FRAMEWORK FOR RESEARCH IN IS/IT INSTRUCTION

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An integrative model of instructional design and learner motivation (drawn from the education research literature) provides a theory-based conceptual framework for research efforts in IS/IT instruction. The components and linkages of the integrative model are reviewed. The model elucidates issues in instruction that have, heretofore, received little attention from researchers in IS/IT instruction and encourages consideration of those elements in future research.

INTRODUCTION

The present effort was undertaken to identify a framework for research in IS/IT instruction that is grounded in existing theory and research from the education literature. An examination of theory and research in higher education revealed a model that integrates instructional design and learner motivation theories. The model is a promising one that can provide a theoretical basis for future efforts of researchers and practitioners in IS/IT instruction.

This paper begins with a brief review of the primary theories of instructional design and learner motivation. This is followed by a detailed review of a recently developed model that integrates instructional design and learner motivation theories. Finally, implications for research and practice in IS/IT instruction are drawn from the integrative model.

INSTRUCTIONAL DESIGN THEORY

The instructional design literature provides a body of knowledge that prescribes actions to optimize desired instructional outcomes, such as student achievement and affect. Compared to curriculum theory, which is concerned with what to teach, instructional design theory deals with how to teach it (Snelbecker, 1985). Instructional design has long been viewed as the "linking science" between learning theory and the practice of instruction (Dewey, 1913; Reigeluth, 1983).

According to Reigeluth (1983), a theory of instruction consists of three major components: instructional methods, instructional conditions, and instructional outcomes. The relationships proposed to exist among these components are shown in Figure 1. The methods in Reigeluth's theoretical framework are specific strategies an instructor can employ in organizing, delivering, and managing the course. Conditions refer to those variables, such as learner characteristics, that constrain or interact with instructional methods and typically cannot be manipulated by the instructor. Outcomes include the influences of instruction and are usually measures of student achievement and student affect.

LEARNER MOTIVATION THEORY

Instructional design is intended to be learner-centered (Edmonds, Branch, & Mukherjee, 1994) and recent authors have suggested that learner motivation is at the very core of our understanding of course outcomes (Bigge & Hunt, 1980; Keller, 1979; Keller & Kopp, 1987). For many years, however, learner motivation was not a specified variable in instructional design theory. Keller's (1983, 1984) educational model for designing motivating instruction addressed this limitation and confirmed the importance of student beliefs and perceptions in educational contexts.

More specifically, Keller (1983) proposed a model that defined learner motivation as a function of attention (A), relevance (R), confidence (C), and satisfaction (S), or "ARCS" as it has become commonly known. Attention refers to the degree to which course content arouses and maintains learner interest. Relevance reflects the learner's perception of the extent to which the course content relates to important personal goals. Confidence represents the learner's expectancy for success. Finally, satisfaction is concerned with the extent to which the learner experiences positive consequences in the instruction. A fundamental tenet of the model is that the four components are necessary conditions for students to become and remain maximally motivated to learn. Keller's work is grounded in theories of expectancy and social learning and has been used extensively for prescribing instructional strategies that are likely to enhance the motivational quality of instruction (e.g., Bohlin, Milheim, & Viechnicki, 1993; Main, 1993; Pearson & Carey, 1995; Small & Gluck, 1994).

AN INTEGRATIVE MODEL

For over a decade, a gap in the instructional literature was the integrating link between learner motivation theory and instructional design theory. Moore, Burke, and Baldwin (1997) recently developed an integrative model of instructional design and learner motivation. In their integrative model, learner motivation is proposed to partially mediate the effects of instructional methods and conditions on instructional outcomes.

The detailed model developed by Moore et al. (1997) is shown in Figure 2. The model reflects the relationships proposed to exist among learner motivation and instructional design components in the general context of higher education. In the following sections, each of the components in the model is reviewed.

Instructional Methods

Instructional methods encompass the different ways that different outcomes can be achieved under different conditions. Reigeluth and Merrill (1979) identified three types of instructional method variables: organizational strategies, delivery strategies, and management strategies. Organizational strategies are methods of organizing the subject matter content selected for instruction (e.g., decisions regarding the sequencing and synthesizing of content and the use of alternative representations or examples). Delivery strategies are methods for conveying the instruction to the learner and/or for receiving and responding to input from the learner (e.g., characteristics of the media, teachers, and textbooks). Management strategies are methods for making decisions about when to use certain organizational and delivery strategy components in the course (e.g., decisions regarding how to individualize the instruction and when to use a particular communication or presentation medium). In addition, Moore et al. (1997) proposed a fourth type of instructional method variable -- evaluation strategies. Evaluation strategies encompass decisions and practices related to the design and administration of the course policy for the evaluation of student performance.

Learner Motivation

The learner motivation component of the model encompasses the learner's attention to the course (A), perception of the relevance of the course (R), confidence that he or she can succeed in the course (C), effort, and satisfaction or experience of positive consequences in the course (S). Based on Keller's (1983) theory of learner motivation, the learner attitudes and beliefs associated with attention, relevance, and confidence (A, R, and C) will influence the learner's effort in the learning experience. The learner's effort, and the consequences associated with that effort, will affect the level of satisfaction (S) experienced by the learner.

Instructional Conditions

Reigeluth (1983) identified two categories of instructional conditions: characteristics of the subject matter and characteristics of the student. The study by Biglan (1973) continues to be the primary source of insight into characteristics of subject matter commonly taught in higher education. Biglan identified three dimensions on which subject matter could be classified: (1) the extent to which paradigms exist to specify the appropriate problems for study and the appropriate methods to be used (also referred to by Biglan as "hard" vs. "soft" areas of study); (2) the extent of attention to practical application (also referred to by Biglan as "pure" vs. "applied" areas of study); (3) the extent of concern with life systems.

The research literature reveals the following student characteristics that can influence instructional outcomes: the knowledge, skills, and abilities the student brings to the learning program (e.g., Cronbach & Snow, 1977); the student's personal interests and goals (Keller, 1983); student attitudes toward college coursework (e.g., Eison, 1981). A more detailed review of the literature in student and subject matter characteristics, as well as a consideration of the roles they may play in IS/IT instruction, is provided in the full paper.

Instructional Outcomes

Instructional outcomes generally encompass the appeal, effectiveness, and efficiency of the instruction (Reigeluth, 1983). Appeal of the instruction is usually measured as student affect related to the course experience and/or the student's desire to continue learning. Effectiveness of the instruction is typically operationalized as measures of student achievement. Efficiency of instruction is traditionally assessed as effectiveness divided by "costs" (e.g., student time, teacher time, design and development expenses, etc.).

IMPLICATIONS FOR RESEARCH AND PRACTICE

The integrative model elucidates variables that influence instructional outcomes and, hence, are likely to be of particular interest to IS/IT researchers and practitioners. In general, the model provides a framework by which to view the design and delivery of IS/IT instructional techniques and exercises, as well as their outcomes and associated boundary conditions. For example, the use of Web-based instruction in the teaching of a particular topic can be viewed through this model. The model elucidates important variables (e.g., student characteristics, learner motivation, effectiveness and appeal of instruction) that should be assessed to better understand the outcomes of Web-based instruction and the boundary conditions under which positive outcomes are achieved.

In addition, the model draws the attention of researchers and practitioners to the role of student and subject matter characteristics in instruction. While teachers are likely to agree that instructional methods directly affect instructional outcomes and learner motivation, the model reminds us that student and subject matter characteristics often moderate these effects. That is, a particular method for teaching a particular IS/IT topic may be effective for a certain type of student (e.g., traditional undergraduate students who are relatively young and deficient in work experience) but may be ineffective for other types of students.

Furthermore, the integrative model provides a general framework by which to address issues regarding the instructional use of communication and presentation media. Decisions related to media usage are encompassed in the instructional methods component of the model, and the model reminds us that the influence of media usage on learner motivation and instructional outcomes is likely to be moderated by characteristics of the students and subject matter. Hence, researchers are encouraged to incorporate these variables in future instructional media research.

In the area of instructional outcomes, "efficiency" of the instruction may strike a chord with IS/IT instructors. Efficiency of instruction is defined in the education literature as effectiveness divided by teacher time and expenses related to design, development, and delivery of the instruction (Reigeluth, 1983). Evolving technologies challenge IS/IT educators to keep up with the latest advances and to incorporate emerging technologies into their classroom instruction. However, it is likely that, due to limits on instructor time and other resources, all evolving technologies cannot be effectively incorporated.

Hence, the IS/IT instructor is faced with decisions regarding which technologies and emerging topics to incorporate. Whereas IS/IT instructors have long considered and assessed the effectiveness and appeal of their instructional strategies, the instructional design literature validates our need to also consider the efficiency of instruction. In making decisions concerning the potential incorporation of various technologies and emerging topics in a particular IS/IT course, an instructor is encouraged to consider the efficiency of each (i.e., the incremental increase in effectiveness of instruction divided by instructor time and other expenses associated with its incorporation). This is also an interesting area for future empirical study. Accordingly, researchers are encouraged to investigate questions such as "what is the increase in effectiveness (student achievement of the course objectives) relative to costs (teacher time and other expenses) associated with the use of a particular instructional method for a particular segment of IS/IT subject matter?"

Finally, the integrative model may also provide a theoretical foundation for the design and delivery of end user training. The elements of methods, learner motivation, student characteristics, subject matter characteristics, and instructional outcomes, and the relationships among these elements, are likely to be as crucial in corporate training as they are in the context of higher education. Thus, the model elucidates critical elements to be considered in the design and delivery of end user training, and provides a conceptual framework for further research in this area.

CONCLUSION

A model drawn from research in instructional design and learner motivation was identified in this paper as a promising conceptual framework for research being conducted in IS/IT instruction. In addition, new and important areas for research in IS/IT instruction were elucidated by the model and discussed.

It is hoped that, by bringing this model to the attention of IS/IT researchers and practitioners, future efforts in IS/IT instruction will benefit from more extensive grounding in educational theory. More specifically, by examining IS/IT instructional issues within this framework, researchers should be more likely to incorporate additional variables that influence instructional outcomes and, hence, should arrive at more fully specified models. Ultimately, the goal of researchers and practitioners in IS/IT instruction is to identify instructional methods that, for types of subject matter and students commonly encountered, will increase the effectiveness of instruction. The model reviewed in this paper provides a conceptual framework to support such efforts.

NOTE: Figures and references are available upon request from the primary author.

PANEL DISCUSSION

A REPORT INVESTIGATING A STRATEGY FOR DEPLOYMENT OF IS'97: MAPPING LEARNING UNITS TO LOCAL COURSES WITH ATTENTION TO SIGNIFICANT RECURRING THEMES

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IS'97 is the first curriculum for undergraduate programs of information systems released as a combined effort from the ACM, AIS, and the AITP (formerly DPMA). It is supported by active recognition from IAIM, DSI, INFORMS, IACIS and IFIP. The work has appeared in several draft versions IS'95, and IS'96 and grew directly from the IS'90 work of DPMA. It is based on previous models of the ACM 1992, and the DPMA 1981 and 1986. It is expected that IS'97 will serve as a guide for more than 1000 US programs.

IS'97 describes exit objectives describing the behavior of graduates. It also presents a set of learning units and sample courses. The learning units are cognitively paced to ensure reaching the desired exit objectives.

It was never expected that IS'97 could replace the wealth of knowledge contained with each local individual program of IS Survey data has suggested that the body of knowledge and the learning units are highly representative of aggregate opinion. Yet, individual program have individual requirements, and individual faculty may have special insights that are not adequately identified or described in IS'97.

We are proposing to collect the following information as an attempt to test the deploy ability of IS'97. 1) A list of significant recurring themes important to each of us, 2) a list of courses and their descriptions which comprise our individual programs, and 3) a list for each course the learning units which should be covered in each course, as well as a list of learning units that fit nowhere.

In addition, we propose to identify additions to each of the learning units we'll call a) emphasis areas, and b) local objectives, or test questions. The emphasis areas will describe major points of coverage within the learning unit, and must incorporate appropriate reference to the significant recurring themes. A map will be developed to track the learning unit in which the recurring theme was to be presented. Likewise, local objectives or questions to test the student's knowledge will be developed.

Within IS'97 many significant and recurring themes have been described as curriculum areas and sub-areas. However, there are many other aspects that can be addressed including considerations of organizational structure and management models, and new/emerging hardware, software, and database technologies (Case et al 1996). Likewise, international considerations (Granger 1995), issues of software engineering, project management, and changing models of end user responsibility for data and systems development need to be integrated.

Summaries of our work and experience will be presented. An end goal of our effort, and hopefully of additional members of the society who will work with us will be a more expanded set of learning units. These will be achieved not by changing the goals or objectives of IS'97 (at least initially), Rather, the learning units will be enriched by adding local emphasis points including recurring themes, recurring theme tracking, and specific local objectives. In addition, the mappings to individual university programs will be captured into a database.

ARCHITECTURE AND THE WEB

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INTRODUCTION

Today's information systems (IS) students, the IS managers of tomorrow, are being bombarded by software advertising describing the new technologies that can be used to implement management information systems, including many creative Internet tools. However, recent results of "Curriculum 95", the findings of a joint task force of ACM, AIS-ICIS, and DPMA, don't address this new and exciting technology or the critical role it may play in the future.

Instructors must be concerned with how to incorporate the Web into an IS curricula organized across three areas of knowledge, (which the Task Force endorsed): Information Technology, Organizational and Management Concepts, and Theory and Development of Systems. The Web appears to fit broadly into the Information Technology component which includes Computer Architectures, Algorithms and Data Structures, Programming Languages, Operating Systems, Telecommunications, Database Systems, and Artificial Intelligence. Unfortunately, the Web seems touches all of these technologies simultaneously, and lacking research on the impact from this rapidly changing force, may eventually be "something more" according to the seers of the trade journals.

Members of the field who are charge with teaching about IT may be tempted to immediately dive in, and focus upon narrow techniques that utilize the Web (or tools) that may soon become obsolete. They may also tend to gloss over the Web, focusing solely upon the theoretical issues and traditional systems categories and topics so that the linkage between these theoretical issues and the technological status quo in the field is lost, with the student possibly seeing the instructor as "far behind the times" and irrelevant.

HISTORY AND THEORY

The theoretical issues addressed by the field today concern understanding the value of information, the strategic application of information within organizations, and the methods by which information systems may be constructed, maintained, and evaluated. While a consensus exists within the field about the importance of these three guiding questions, the same cannot be said about the powerful enabling information technologies (typically validated through the marketplace) that have depicted IS as a discipline continually beset by fads, each one of which in its time is proclaimed to be the latest paradigm shift, in the spirit of Thomas Kuhn. The difficulty is that the discipline has had, in fact, more than its share of genuine paradigm shifts, beginning with the shift from a batch, data processing model to an interactive, Management Information Systems (MIS) model, from a centralized, mainframe-oriented model to a decentralized, client-server model, and now to an integrated, component-based, network-oriented model.

Managers have addressed these forces (attempted to control or accommodate IT change) with organizational structures, technology, and information systems components that must have greater flexibility and more rapid payback than ever before, and in the process have as often as not neglected the longer term implications of their strategies. This appears to have caused the emerging issues in the field to be concerned with assessing the value of IS, the strategic use of flexible and adaptive IS in the management of virtual organizations, and the process of change, with special references (today) to the adoption of IT within virtual organizations.

Research evidence does not yet fully indicate how the Web relates to these organizational changes.

It does appear to support the flexible and adaptive requirements for the management of virtual organizations, and may promote an organization's ability to implement change. However, for the Web to be included as a viable IS component for developing solutions, Management Information Systems (MIS) related WWW implementations demand a complete assessment of systems architectures, and consideration of complex Web application implementation issues.

WWW MIS PLATFORM

Significant design related technical issues in WWW development drive the analysis of hardware platforms, workstation communications, and connectivity. Students must recognize that the WWW is a visual medium. Therefore, "web publishing" is fundamentally different from print publishing. Student designers must determine if special features such as data compression are to be added to WWW systems, requiring upgrades to initial systems? Will WWW MIS change the requirements for tools for network monitoring and management, lead to the retraining of network administrators, server synchronization, and server-independent namespaces? Could a WWW MIS create new or subtle differences in data storage and data translation techniques that lead to the loss of data when files are transferred from one environment to another. (Noticeable when transferring files which have been heavily formatted with special fonts and graphic images). Finally, what increased security considerations and application execution and performance concerns are presented by a WWW MIS? The specific target platform and decision topics which must be addressed by instructors and students include:

1. Markup language selection. HTML, and SGML are evolving from the printing industry. This has led to language extensions that may not be supported by different browsers. The designer must choose between developing for the lowest common denominator, using proprietary language extensions that some customers might not be able to see, or maintaining multiple versions of a product. Students (as designers) must recognize that the WWW was originally meant for the sharing of static documents but WWW applications are evolving in the direction of dynamic and multimedia presentations increasing pressures for proprietary extensions to markup languages and protocol standards.

2. Protocol selection. Misunderstanding of the relationships between the various protocols: HTTP, Gopher, and Telnet may lead to mixing protocols, such as HTTP and Gopher (when systems are being created from pre-existing parts) and increasing the complexity of maintenance and operation.

3. Script Language Selection. Scripting languages are evolving (Java, VB extensions, CGI/perl Scripts, etc.) and must be evaluated.

4. Bandwidth selection (availability determination). Necessary bandwidth for WWW MIS must be estimated. It may not be available, even if the desired level of functionality can be achieved with available programming tools.

5. Platform Constraints. Different platforms (various flavors of UNIX, Windows NT, etc.) may handle protocols differently, requiring that all file names be lower case, while other platforms may not impose this requirement.

6. Server Configuration and operation. Planning for server configuration and operation can be overlooked in favor of WWW page design. Unique support and operational concerns must be incorporated into the overall systems design.

7. Page Design and Development. It may appear to be relatively is easy to create a minimally functional WWW page. This can lead to the conclusion that all WWW based development is easy to accomplish. Formalized project management, configuration controls, testing, etc. may then be neglected in favor of ad-hoc "hobby shopping" with an end result of no final delivery of the WWW MIS.

8. WWW Implementation Process. Students must weigh the overall "opportunities" offered from WWW MIS to select or design an appropriate implementation process. WWW may be used to facilitate communication and business processes across departments and technological platforms. The WWW acts as a

toolset for developing applications to manage, measure, and revise work processes spanning multiple workers, applications, and organizations. The WWW technology may also enable units to forward forms, and minimize steps taken by users to complete work processes. One primary WWW outcome may well be to effectively to compress the time between tasks. This is the impact of new WWW systems which use data entry applications to streamline the flow of information and eliminate paper.

A typical student (planning a project or development effort) may need to consider architectural issues requiring that one select from a number of competing environments at this time. Lotus Notes provides an environment in which Web-based applications can be developed rapidly by non-technical staff with a minimum of training and guidance from IS professionals. Oracle provides an environment in which structured data can be effectively managed, which is relatively easily integrated into other operating environments, such as both Lotus Notes and the Web, and for which a relatively large number of competent IS professionals are available. Windows NT version 4.0 provides a robust platform for the deployment of Client/Server and Web-based systems, yet minimizes the system management burden present in other operating environments, such as Novel Netware and the various flavors of UNIX.

RECOMMENDED: A PROACTIVE RESPONSE

A number of organizations have now begun to publish standards for their systems (architectures) to ensure component integration and proper system operation. Techniques for measuring conformance are also required so one can determine whether or not a component is compliant with an architecture, to identify current or potential interoperability problems, and define what improvements can be made to achieve compliance. One very large organization, the DoD (Department of Defense) has recognized that an unprecedented degree of integration and interoperability is required of DoD systems, both for legacy systems and for systems that are under construction. It has developed and published the Defense Information Infrastructure (DII) Common Operating Environment (COE) is the key to achieving this vision of integration. All new Defense Information System Agency (DISA) systems are being built using the DII COE while existing DISA systems are being migrated to use the DII COE. OSD has recently issued a directives that military systems, except for weapon control systems, use the DII COE.

The DII COE is a complex set of rules (which can be used to address the inclusion of the Web and its components). Compliance is presented as eight levels of progressively deeper integration, because compliance cannot be an all or nothing proposition for legacy systems. The levels progress from a state of "peaceful coexistence" to "federation of systems" to true integration. The levels of compliance map to levels of interoperability, and that interoperability increases as the level of DII compliance increases.

The appendixes to the architectural framework contains a series of questions, in a checklist format, which are organized by compliance level. The philosophy behind this design for the compliance checklists is to begin with an agreement on a set of standards that ensure non-interference when installed on the same LAN, then non-interference when installed on the same workstation, and finally to interoperability through sharing the same software and data.

The COE is presently available for NT only on Intel-based platforms (e.g., 80x86, Pentium). The NT questions in the checklists are applicable only to that hardware environment and will be upgraded as required if NT support is made available for non-Intel platforms. The concept conveyed by the checklist items are applicable regardless of the hardware platform or operating system, but for clarity are often worded in such a way as to make the statement operating-environment-specific. The checklists are organized in such a way as to evaluate individual segments, but the compliance of individual segments can be eventually combined into a composite compliance level.

IS managers may eventually wish to organize their own compliance checklists to present their own architectural vision for an organization. Students may need to be taught how to identify and adopt compliance categories and levels, defined by an organization, that promote a reasonable approach to migrating legacy systems into an adopted or developed COE for an organization. The Web technologies may well offer a previously unavailable opportunity to ensure that legacy systems do not destructively interfere with each other when located at the same operational site.

IMPLICATIONS FOR THE WEB

Instructors must help students deal with the Web marketing approaches which currently attempt to infiltrate users at department levels. The student must walk a fine line between the centralization that reduces flexibility and decentralization (without architecture, checklists, or standards) which can cause duplicate system deployments, and solutions that are not interoperable. Instructors may want to inoculate their students against the marketing hype which says the best way to deploy is to quickly involve the users in a content creation exercise with easy to use products. Creating a solid internet and intranet solution involves establishing a clear architectural vision, enterprise decision structures, and open standards based technologies.

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ETIQUETTE IN TELECOMMUNICATIONS AND WEB PAGES

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INTRODUCTION

The rapid advance in telecommunications technology in the past several years has created novel ways in interpersonal communications. Today many people find that their daily communications are not limited to telephone, memorandum, and postal mail. Telecommunications tools such as e-mail, voice mail, web page, and pager messages are becoming common place. While telecommunications technologies offers more efficient and effective ways in communications, it is necessary for people to know the common etiquette and communications styles. Because these styles and etiquette were de facto standards, they vary among users and organizations.

DRAFTING THE MESSAGE

Because people who use Internet and e-mail may be exposed to hundreds of electronic messages per day, including junk mail, these electronic messages should be concise and to the point. Furthermore, one should not get caught up in excessive punctuation. Many messages contain dozens of exclamation points at the end of a sentence for added emphasis. Unlike the formal English writing style, exclamation points are just another form of ending a sentence in e-mail. However, if one or two exclamation points are adequate, additional ones may tend to offend rather than impress the reader.

Electronic messaging systems, including e-mail, are often used as substitutes for traditional letters and memos. Because the goal is to get the message out quickly, generally informal phrases are used more frequently than sentences, while grammar, spelling, and punctuation errors are typically overlooked. However, not all e-mail messages should be casual. The KISS approach might well be considered -- keep it short and simple -- with both sentence structure and paragraph development.

Width of Messages

For various reasons, e-mail messages may become too large on the viewer's display. This is because some e-mail software do not have the ability to wrap a long line and display them in multiple lines on the screen. Therefore, it is the sender's responsibility to make sure the message fits the viewers' screens.

Abbreviations and Smileys

The range of expression and emotion is possible when electronic mail is used and chat is limited, but the Internet is far from being boring and mundane. Emoticons, abbreviations, and smileys (also called "smilies") bring life and nonverbal communication to the Internet (Eddings, 1994). Abbreviations are frequently used with e-mail to save keystrokes and on-line access time. Messages can also be imbedded with visual and auditory cues called smilies or emoticons. They are simple strings of characters that are interspersed in the text to perform non-verbal communications.

Salutation, name, and author address

In an Internet message, the salutation does not have to be formal. People can start the message with "Dear Mr. Smith", "Dear John", or just simply "John:". Some people will suggest the tone of the communication or the familiarity with the receiver will dictate the degree of formality.

Similar to formal letter style, an electronic message ends with closure such as sincerely, regards, etc. and your name, all but the signature. It is common for people to add their e-mail address, Web page location (URL), telephone numbers, and/or home address to the bottom of the message. Some people go further to add a business logo drawn by keyboard characters and/or a favorite quote.

Responding to a message

Because an authenticated electronic mail is a legal document, it should be treated at the same level as a hard copy letter. In organizations, which implemented Total Quality Management (TQM) programs, employees must respond to an e-mail inquiry within 24 hours. As a rule of thumb, people should respond to all e-mail inquiries as soon as they can. In case time is needed to study the question for a proper response, an acknowledgment and a promised date for a response is sufficient. This is to let the sender know that his/her message is not lost and give him/her an idea of when to expect a response. In all instances, it is polite to respond to all electronic inquiries. It is also helpful to keep the same thread by using the same *Subject* line and to cite parts of the original message in response to the e-mail.

WEBTIQUETTE

Because the number of guidelines and etiquette for web pages are still growing with the advance of technology used in web page development, common guidelines in addition to those of the current graphical user interface (GUI) are:

1. Use proper colors for foreground lettering and background. As a rule of thumb, dark text on light background provides the best readability contrast.
2. Keep Graphics within default window width.
3. Minimize time to download web page by reducing graphics, animation, and audio played in your web page.
4. Give credits for all intellectual works such as graphics, code, citation used in your web page.
5. Give alternative choices for features that may not be viewed by viewers who don't have the same browsers or tools to view the intended features.
6. Include your E-mail address to facilitate communications.
7. Make access and web search user-friendly by using meaningful domain name and don't forget to put the title on your web page.
8. Be creative and unique in your web page.

VOICE MAIL

Currently, most people follow the sample greetings suggested by the manufacturer in the user manual for their personal answering service and these are the defacto etiquette in personal voice mail. With the advance in telecommunications technology, the use of automated answering services for customer services and business transactions are common place. However, lack of user interface design standards in this area has caused numerous problems for telephone users. In order to improve voice mail design, the following design guidelines are suggested:

1. Use short and simple greetings to greet customers. The voice must be clear.
2. Always allow users to talk to a real human operator if they want to do so. This is to allow users who do not have touch tone telephone or who could not understand how to use the options to complete their message.
3. Allow the user to exit to the previous menu or main menu and to correct entry errors without terminating the telephone connection. Too often voice mail menus lead users to a dead end or prematurely terminate the connection after a transaction is

performed or an error is made. For users who want to try another option, exit to a previous menu or main menu is always helpful and thus reduces the number of repeated calls.

4. Allow users to say a number as an alternative to press a touch tone button to select options.
5. Put the most commonly used options as the earliest options in the menu system. The 80/20 rule applies here: 80% of the customers use a few common options. They should not be subjected to a long list of menus before reaching the desired option.
6. Allow data gathered by the answering service to be transferred to other voice mail systems or human operators. Too often, after customers give account numbers and other data to the automated system, the system then transfers them to the new system or human operator who asks for the same information again.

PAGER EMOTIMERIC CODES

According to Motorola, currently there are about 39 million pagers in use in the U.S. (Hierlmaier, 1997). In comparison with other high tech communication gadgets such as cellular phones, the major drawback for current pagers is that there is not much information that can be displayed on a pager screen except for a group of numbers. The receiver must use a telephone to communicate to the caller, and the geographic area in which the pager can receive the signal is still limited. While new pagers that can display text are coming on the market, current numeric-only pager holders have some ability to communicate through pagers by using common emotimeric codes available.

Currently the screens of pagers can display more than just phone numbers. Similar to existing emoticons and abbreviations used in e-mail, pager emotimeric codes are developed and have become well accepted in pager communications as a way to extend the capability of the pager (see Table 1).

TABLE 1

EMOTIMERIC CODES

Codes	*Meanings*
0001000	I am feeling alone now
020202	Just thinking of you
080808	Kisses and Hugs
10-2-1	It is possible, there's a chance
10000001	I miss you
13	I am having a bad day
18	I ate
10	You are perfect
101	Easy task, I can do it
747	Let's fly
411	I need more information
911	I desperately need help
2468	You are terrific
90210	I am feeling kind of witchy

Adopted from Hierlmaier (1997).

PROBLEMS AND ISSUES

Flames

Cruising on a busy information highway is not much different from cruising on a busy interstate highway because collisions frequently occur. Most serious collisions of individuals and groups were caused by flames, the action that causes irritation or anger from readers. It's basically an electronic attack message.

Sometimes the reason for a flame is quite obvious, but in other cases it is just a case of misunderstanding. An innocent sentence in an article posted on a newsgroup may be misinterpreted by thousands of other readers and may generate flames.

Privacy

Unlike postal mail, e-mail and newsgroups provide neither privacy nor security. E-mail can be likened to a postcard -- anyone can read it.

E-mail privacy within a company is not covered by U.S. Federal law. The Electronic Communications Privacy Act of 1986 only prohibits inception or disclosure of e-mail messages by parties outside the company. In the case of Alana Shoars vs Epson America Inc., the judge dismissed the lawsuit charging of e-mail piracy against Epson because e-mail does not fall within the state wiretapping laws (Wagner, 1996; Information Week, 1994; Bjerklie, 1993).

Lead time

While e-mail allows messages to reach destinations at lightning speed, it is necessary to allow lead-time for the receivers to read your e-mail. This is because many people do not read their e-mail frequently. Because many organizations today require their employees to reply to e-mail within 24 hours, the rule of thumb is to allow readers at least one day to read your e-mail messages.

CONCLUSIONS

With the advance of telecommunications services, electronic messages will become the dominant means of communications for Americans in the year 2000 and beyond. However, the popularity of electronic messages that provided added benefits to all of us also came with chaos and abuses. Knowing the necessary etiquette and design styles in the electronic world will help us to communicate effectively and efficiently with the rest of the world while avoiding conflicts with others.

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HAWAII'S ELECTRONIC SCHOOL PROJECT: A CURE OR ANOTHER CREATION OF THE GOD OF TECHNOLOGY?

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Hawaii's Department of Education has been plagued with a common but curable disease of inadequate or "low performance" on national standard exams (e.g., ACT and SAT). Evidence of this disorder appears on the front page of the Honolulu Advertiser (12/11/96). The main headline reads, "Student Achievement Score Falls." The article stresses that Hawaii's general reading and math scores have declined. This type of declivity is an epidemic that has spread throughout many of America's public schools. The state of Hawaii is not benign to this national cancer. This presentation is a qualitative description of one of Hawaii's educational reform projects: The Electronic School Pilot program. This case study identifies Hawaii's innovative method of integrating advanced telecommunications technology into the classroom as a proposed cure.

The purpose of this paper is to explore the telecommunication evolution and the technology processes involved with Hawaii's Electronic School Pilot Project. This presentation triangulates education, technology and policy to introduce an integrated view of the pilot program. A brief literature review conveys support and opposition related to the subject of telecommunication's technology in the classroom; conclusion and recommendations reveal the structure, definition, technological procedures and concerns of the Electronic School pilot project.

INTRODUCTION

"Too much apparatus, like too much bureaucracy, only inhibits the natural flow [of teaching and learning]." - Theodore Roszak[1]

"I am not arguing against using computers in school. I am arguing against our sleepwalking attitudes toward it, against allowing it to distract us from more important things, against making a god of it." - Neil Postman[2]

The state of Hawaii is currently under an educational restructuring program focusing on decentralization. Over the past decade there has been a perpetual shortage of secondary school teachers in Hawaii. The (DOE) Department of Education points the blame towards the University of Hawaii, stating that University's College of Education is not producing well-educated and qualified teachers. The university claims that Hawaii's secondary students enter the university system ill-prepared.

Despite the answer to this debate, it is obvious that a change is in order. Like many other public school districts across the nation, Hawaii is realizing that education is a life-long process. Education is not a set time or place and all educational project designs and curricular development must place the student at the center and not the peripheral. Hawaii's Office of Information and Telecommunication Services, (OITS) has adopted Howard Gardner's concept of "Multiple Intelligence". In a federal grant proposal prepared by OITS the writers state that teachers must pay attention to the varying learning styles and the multiple intelligence manifest in the students they are teaching. Schools throughout the country have developed plans and projects to help cure their educational ailments. Some school systems have used such methods as involving corporations in their overall operations. Others have turned the educational reform over to community-based management (e.g., local businesses, volunteers and support groups). And some have even taken their concerns to the federal government.[3] Regardless of the various methods for improvement by different school districts the one remedy most have in common is incorporating information and telecommunication into the classroom; this equates to an antibiotic injection of technology.

The Challenge Grant proposal developed by OITS, suggests that the world is rapidly changing, and the only constant that we as citizens of the world can count on is change itself. As the world changes, so do people and the needs of people.. Perhaps Ôchange' is a cause and effect which contributes to the learning deficit of today's youth.

Diane Ravitch (1992), Assistant Secretary for Educational Research and Improvement and Counselor to the Secretary of the U.S. Department of Education states, "Our kids usually perform at a level somewhere between the middle and the bottom on international assessments." Ratvich contends that our society needs a new generation of schools to help the new generation of students reach higher learning standards.

> "Agriculture is no longer the primary occupation; most mothers are in the work force rather than at home during the day; students now learn in very different ways,, such as through television, computers and other visual media; society is facing numerous challenges unknown a generation ago; and everybody needs a good education today, not just the 50 or 60 percent of students who are college-bound or headed for skilled jobs."(17).[4]

It is obvious that today's youngsters do not learn at the same pace or in the same manner as did their parents or grandparents. The mere development, of advanced electronic technology has defined the students of the 20th century as technologically unique. Kristine Woodall labels today's youth as the "Sesame Street Generation." Woodall contends that the introduction of[5] television to children of this era has fostered their desire to be entertained rather than educated. Is it the creation of Sesame Street and similar programming that has demanded that teachers resort to "Edu-tainment" rather than traditional lectures? Or can it be that the evolution of man's learning style has dictated the creation of Sesame Street-like programming?

Regardless of the answer to the previous questions, the fact of the matter is our educational dilemma demands that new models of teaching and learning be developed. This means a shift and an expansion in the educational delivery systems. Neil Postman (1996), suggests that society no longer has sufficient narratives to support our traditional educational models. He believes that we have moved far beyond the paradigm that held schools to be places where we trained students to become citizens for an American democracy.

Groennings (1992), asserts that corporations have the biggest stake in the success or failure of education in the United States. He reasons that we need educated people to both produce and consume our products. "Corporations like American Express Company do not earn any money from poor or uneducated people, nor do thousands of other U.S.-based corporations" (15).

In the Conference Board's Eighth Annual Business/Education Conference Report (1992), it was determined that corporate America pays approximately $20 billion per year for insufficiently educated workers. The report shows that a large portion of this money is for bilingual training, but a substantial amount goes for remedial education. Sven Groennings says, "In other words, learning that should have occurred elsewhere" (15).

Speakers from many sectors - business, education and government agreed that corporate involvement is crucial to the success of school reform in the United States. The report confirms that such involvement carries expense, however, the cost of a poorly educated society is higher still.[6]

LITERATURE REVIEW

Americans have traditionally placed great faith in the power of technology to solve the myriad of social, economic, and political problems which have faced us. Often in our enthusiasm for technological benefits, however, we failed to anticipate the social and environmental side effects of technological innovation. - Joe Kincheloe[7]

Hawaii has clearly defined its basic needs for educational reform. These needs include accommodating students' cognitive learning styles. The need to educate all students including those who are under challenged and at-risk. The need to conform to the recent budget cuts and resource shortfall (e.g., facilities, teachers, and programs). The DOE must maximize outcomes, ensure timely and effective delivery of curricula and meet the needs of all learners -- all ages, geographic settings, subcultures and those academically at risk.

The Electronic School proposes to support this educational reform in Hawaii by increasing access to learning technologies that enhance educational opportunities for students and parents at more convenient times and more accessible places. The bottom line is this initiative hopes to provide greater economic opportunity.

Neil Postman asserts in his book, The End of Education (1995), "There was a time when educators became famous for providing reasons for learning; now they become famous for inventing a method." Perhaps Postman's accusation warrants some merit, however the introduction of the Internet into the classroom as a mode of learning must at least be tried and tested before condemned for being a method rather than reason. It must also prove itself worthy before being praised and uplifted to Ôgod-like' status.

Postman compares the technology god (he uses a small g) to religion or as he labels it narratives. He believes that in order for a student to learn, he/she must have a reason or a purpose to learn. Much like a reason or a purpose that a religion and its deity gives to a person's life. In summary, he contends that for some people to live without a religion or narratives, life has no meaning. In comparing education to narratives, Postman cautions that without meaning, learning has no purpose and schools are houses of detention rather than attention. It is safe to assume that all religions have a belief system. Those associated particular religions are known as "believers of that system.

Postman (1995) declares that important distinctions are made among the different meanings of "belief": but at some point it becomes far from asinine to speak of the god of technology - in the sense that people believe technology works, that they rely on it, that it makes promises, that they are bereft when denied access to it, that they are delighted when they are in its presence, that for most people it works in mysterious ways, that they condemn people who speak against it, that they stand in awe of it, and that in the born-again mode, they will alter their lifestyles, their schedules, their habits and their relationships to accommodate it. If this be not a form of religious belief, what is? (38).

He continues this thought by stating that in all strands of American cultural life, one can find many examples of technological adoration. Postman suggests that one cannot find more enthusiasm for the god of technology than among educators. "In fact," he states, "There are those, like Lewis Perelman, who argue (for example, in his book School's Out) that modern information technologies have rendered schools entirely irrelevant, since there is now much more information available outside the classroom than inside" (38).

Dr. Diane Ravitch, former Assistant U.S. Secretary of Education, envisions, the challenge that technology presents to the tradition that "children" (and adults) should be educated in a specific place, for a certain number of hours, and a certain number of days during the week and year. In other words, that children should be educated in school. Imagining the possibilities of an information superhighway offering perhaps a thousand channels, Dr. Ravitch assures us that: In the new world of pedagogical plenty, children and adults will be able to dial up a program on their home television to learn whatever they want to know, at their own convenience. If Little Eva cannot sleep, she can learn algebra instead. At her home-learning station, she will tune into a series of interesting problems that are presented in an medium, much like video games... Young John may decide that he wants to learn the history of modern Japan, which he can do by dialing up the greatest authorities and teachers on the subject, who will not only use dazzling graphs and illustrations, but will narrate a historical video that excites his curiosity and imagination.[8]

Postman insists that Ravitch's point of view is a bit unrealistic. He proclaims that her future narrative of Little Eva doing algebra instead of going to the movies because she can't sleep is all bit ridiculous. He argues, ". . . what Ravitch is talking about is not new technology but a new species of child" (39). He agrees that new technologies do make new kinds of people, but a 20th century child will more than likely play a video game, watch a movie or phone a friend if he/she is bored or insomniac.

Envisioning the imagined or futuristic world one may ponder its determinism. The technology is here or will be: we must use it because t is there; we will become the kind of people the technology requires us to be; and, whether we like it or not, we will remake our institutions to accommodate the technology. "All of this must happen because it is good for us, but in any case, we have no choice," Postman proclaims (40). He claims that this point of view is present in nearly every statement about the future relation of learning to technology. ". as in Ravitch's scenario, there is always a cheery, gee-whiz tone to the prophecies," he warns. In reference to cheerleading for technology in learning the following is a prophecy produced by the National Academy of Sciences, written by Hugh McIntosh.

School for children of the Information Age will be vastly different than it was for Mom and Dad.

- Interested in biology? Design your own life forms with computer simulation.
- Having trouble with a science project? Teleconference about it with a research scientist.
- Bored with the real world? Go into a virtual physics lab and rewrite the laws of gravity.
- These are the kinds of hands-on learning experiences schools could be providing right now. The technologies that make them possible are already here, and today's youngsters, regardless of economic status, know how to use them. They spend hours with them every week- not in the classroom, but in their own homes and in video game centers at every shopping mall.[9]

Apparently, Mr. McIntosh has not read Arnold Gibbons' book, Information, Ideology and Communication (1985). Gibbons contends that not everyone is privy to advanced technology. He would disagree with McIntosh's statement that regardless of economic status, all youngsters today know how to use the technology that is available today. Gibbons' book is centered around an international philosophy regarding policy, but can be applied to the disparity in our country on a local and national level. Gibbons characterizes the use of computers in this manner: "But what can be said about the computer? While it has simplified things at one level, it has complicated them at another. Advanced computer technology now is the sacred preserve of rich countries [and rich people within those countries] and reflects the disturbing gap in riches, technology and information resources at all levels" (10). He believes that while rapid achievements information technology takes place, discontent grows between the rich and the poor. This increases the animosity and inequity among the "haves" and "have nots".

Postman would possibly concur with Gibbons in rejecting the ideas presented in the previous scenarios. Postman believes that Ravitch and McIntosh present examples of a technological solutions to psychological problem. Alan Kay of Apple Computer, insists that any problems the schools cannot solve without computers, they cannot solve with them. Although an activist for computer technology in schools, Kay, like Gibbons (1985) and Postman (1995) believes that the god of Technology may be a mixed blessing. "It is often asserted that new technologies will equalize learning opportunities for the rich and poor. It is devoutly to be wished, but I doubt it. In the first place, it is generally understood by those who have studied the history of technology that technological changes always produce winners and losers -- which is to say, the benefits of new technologies are not distributed equally among the population. There are many reasons for this, among them economic differences" (47). Postman declares that it would be astonishing if computer technology equalized all learning opportunities. Whether technology will become the great socio-economic and cultural equalizer or not, it is still not the most essential element for healing all educational afflictions.

Peter Krass suggests in an Information Week (October 21, 1996) article titled, Internet? How About A Pencil?, that President Bill Clinton and Vice President Al Gore have not made the grade with public schools despite their good intentions.

Krass asserts that Clinton's reelection platform featured grand goals of wiring every public school in the nation to the Internet. This can be proven a factual assertion, when one investigates the NetDay96 proclamation created by the President and Vice President Gore.[10] Krass claims that Clinton's rhetoric made for a great political sound bite, but there are deep rooted reasons why getting an Internet connection is not the top priority for many of the nation's schools. He uses the example of the troubled public schools in Brooklyn, N.Y. According to a just-released survey of 215 principals in the borough, they've got more immediate needs on their minds:

- Plumbing that is poor or failing, reported by nearly one-third of the principals.
- Windows in poor condition, cited by more than half the schools. At one school, the panes are falling out.
- Playgrounds that are unacceptable, reported by nearly two-thirds of the schools. One reported a large hole with a barricade around it.
- Roofs that need repair, cited by more than 40% lack of space: Nearly half the principals say classes are overcrowded. So what will it be for the next generation: windows or Windows?" Krass asks.

In a recent article in the Honolulu Advertiser[11], Emma Pavich expressed a different but yet another fear of this thing called advanced information technology. Pavich was amazed that the teacher in her Internet training class informed her that with internet technology, very soon students would be able to learn everything they need at home. "How would children learn to make friends and be friends? How would they learn to talk and play?" she pondered. Weeks later Pavich noticed her own students making dates and sharing intimate thoughts via the Internet. She was quite disturbed by the notion that students who had not yet met anyone they wanted to date in real life would be eager to find Mr. or Ms. Right over the computer screen. This social issue and others are what have some parents concerned about internet technology in the classroom. Pavich claims that children are becoming lost in this "Electronic Community" and false world where friendship and intimacy are built on anonymity. Pavich urges parents to disconnect their children's link to cyberspace before their children become disconnected with the real world. She believes that despite the wonderful advantages the Internet offers us, parents and teachers must remember the greatest present we can give a child is our presence in their space, including their "cyberspace".

Steven Miller (1996) views the Internet as an advantage for parents and children of single parent homes. He contends that most single parents work outside the home. He believes the use of email, bulletin boards and on-line conferences will allow people to participate in public life at times and locations that fit within their schedule (329). Ideally, this will allow the parent to spend more quality time with the child, whether it be cooking, playing, talking or doing homework assignments together via the net.

As I surfed the WEB for research material I came across a website called Exploring Technology and School Reform (1996), the article entitled "Trends in Education" written by Andy Carvin gave a positive analysis for the use of computers in the classroom.[12] Carvin writes that technology plays a major role in the reformation of schools. Technology reduces professional pressures on teachers and increases the efficiency of student comprehension. Carvin insists that from a structural viewpoint computer networking is creating a professional bond between teachers as well as administrators never seen before in the history of education: Traditionally, every classroom is an island unto itself, with the teacher instructing, assessing and remediating children with limited contact with other teachers, even within the same school. Networking allows teachers to exchange lesson plans and advice and debate instructional methodologies with peers around the globe at the touch of a keyboard. . . . the Internet has created electronically a professional fraternity between educators (3).

Carvin contends that computers are an invaluable tool for providing active collaborative learning and assessment. He claims that word-processing programs allow students to become independent publishers of their own ideas and opinions and email provides opportunities for "peer review" and group editing. He suggests that multimedia packages offer true inquiry-based learning, where students must construct and demonstrate solutions to a variety of in-class projects. "This is not to suggest that computers are used in reform to replace the role of the teacher, realistically that would be both undesirable and impractical," Carvin insists. Instead he says the computer must be recognized as an effective teaching tool which assists the educator (3). Despite the criticism of some of the literature presented, Hawaii has proposed its own technological solution to school reform. The Office of Information and Telecommunication Services, (OITS) within the Department of Education, has spear-headed a plan that garnished them a $4.7 million Challenge Grant from the federal government.

CASE STUDY

> Hawaii wants its students to become Hi-Tech, so that the world will look to Hawaii as center for technology in the Pacific, rather than just a recreational resource. - Marsha Mooradian

The five-year Electronic School program was designed to meet the challenges and changes inherent in the necessary reform in our educational system. In a personal interview with Marsha Mooradian,[13] I was introduced to the multi-dimensional program of the Electronic School. "Our goal is not to try to eliminate the traditional model of education. We are proposing a third dimension to an existing two dimensional curricula" declares Mooradian, CO-chair of Tech Corps Hawaii.[14] "The existing classroom contains a text book and a teacher. the Electronic School will add another element by introducing the internet and other communication systems." Mrs. Mooradian believes that this new electronic model will transform the traditional school model into a virtual learning center. It will require that the students become more independent learners. "Instead of giving them the information via traditional textbooks, they will have to go and get it for themselves," Mooradian emphasizes.[15]

Hawaii is one of 24 school districts in 16 states receiving "Challenge Grants for Technology in Education" from the U. S. Department of Education. Marsha Mooradian, who has a background in education was one of twelve writers of the grant proposal. Mooradian says that Hawaii was at an advantage because they saw the original announcement about the grant early, via the Internet. Mooradian had the assistance of her husband, Vice President of SETS and his company, to assist with the technical writing and the design of the logo for the proposal. The proposal was strengthened by letters of financial support and commitment from local businesses and community organizations like MHPCC, GTE Hawaiian Tel, Oceanic Cable, the HERN project and the University of Hawaii. The award winning proposal was drafted, revised and completed within six months. Mooradian believes this could not have been accomplished without the dedication and collaboration of all of the partners of the project.

The major partners and contributors are (MHPCC), Maui High Performance Computing Center and Tech Corps Hawaii, the Department of Education, a 155 member consortium of educators, business people and legislators, notably Senator Carol Fukunaga's office.
The Technical Set-up:

Comprehensive connectivity is the key to much of the success of the Electronic School. Oceanic Cable in Hawaii is committed to contributing network connectivity for approximately 100 schools. This translates to a contribution of over $6.7 million over the five year period. GTE Hawaiian Telephone Company is offering a $2,000 credit to each school that connects to the Internet via their 56K lines. Maui High Performance Computing Center (MHPCC) is providing Internet connectivity for all Hawaii's State Department of Education Schools. There is no need for an outside Internet service such as, LavaNet, AlohaNet, CompuServe or AOL. This equates to a savings of more than $2 million over five years. This collaboration of local business and local school districts is the epitome of successful educational reform tactics.

The Electronic School has also developed partnerships with a number of software, hardware and multimedia developers who will assist in creating marketable products. One of the software products that Allen Cole, Advance Technology Research (ATR)[16] director and CO-creator of on-line courses for the program, boasts about is Tango. Tango is a FileMaker program that runs on the Macintosh systems. It is known as a common-gateway interface. Tango for FileMaker is a rapid application development tool that allows Web developers to easily integrate

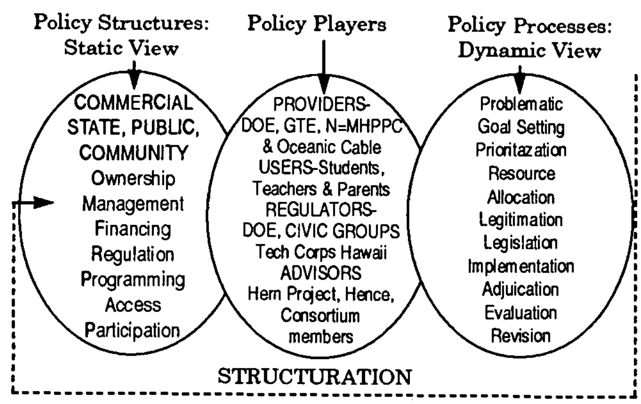
FileMaker Pro databases to the Web. The product was chosen by Cole because all of the schools involved in the pilot program use Macintosh hardware. When asked why Macintosh has a monopoly on Hawaii's DOE; Cole responded by saying that Macintosh is "user friendly hardware". "Mac's excel in innovation, most schools across the nation use them and I believe we get a great deal on the price," Cole laughed. One of Cole's many jobs is to maintain the Web server for the program. That server is a Web Star system which gets about 850 hits per day and ironically is a IBM. Other technical support members are Electronic Image Inc., Rising Wave, SeaSeer, EKV Productions, Inc. and KITV Channel 4 Television. These supports will assist the pilot project in development and packaging.

Marsha Mooradian insists that this program will be a success because of the strong supportive physical as well as people infrastructure in place.

In the area of curriculum development several groups have and will continue to provide guidance and expertise. Throughout the project, Electronic courses will be available to Hawaii public school students as well as students in the Chicago Systemic Initiative, which will serve as a field site for eschool curriculum. The Western Association of Schools and Colleges (WASC) will assist in developing criteria for accreditation by the International Council of School Accreditation Commissions (ICSAC). The Center for Excellence in Education will also help with developing this criteria as well as collaborate with the Electronic School on quality course content and dissemination of courses across the Nation and internationally.

The diagram presented on page 11 has been modified from lecture materials of Dr. Majid Tehranian (1992), Communication professor at the University of Hawaii. The overlapping of the circles indicates an intertwining of relationships involving the key players in the process of this telecommunication policy discourse. The static view of the policy structure is positively affected by the policy processes of the dynamic view. The continuous discourse among the policy players within this structuration has produced the infrastructure of the Electronic School pilot project. This was achieved by much communication and negotiation regarding all of the items within the "Dynamic View" circle, for example, problematization, goal setting, legislation, implementation and so on. The overlapping has occurred in this project because the policy players are diverse members of many of the groups mentioned in the "Static View", for example the DOE-state, MHPCC-commercial, Tech Corps Hawaii-community, Consortium members-public and so on. For the purpose of this paper the definition of Dynamic pertains to energetic: relating to physical force producing motion. The dynamic portion of this policy diagram permeates the structure and generates change and advancement. The definition of Static means acting by mere weight without motion:relating to bodies or forces at rest or in equilibrium;not moving not acting. Needless to say, the Electronic School would not be in progress if the key players adapted only the static view. Following are the results of effective community and commercial collaboration.

FIGURE 1
Hawaii's Electronic School



Pilot Project Policy Formation

The current courses available on-line are:

Shakespeare On-Line -1/2 credit, Language Arts Elective. This course is designed to offer a survey of the dramatic works of William Shakespeare, including discussion about the background of the time period, the dramatic form, the theatrics tradition, and the significant themes covered. This course is taught by Aaron Mersberg, whom I had the pleasure to meet. His interactive teaching style has made this one of the more popular courses in the program. Cole took a view of the class grade sheet and surmised that all of Aaron's students are highly motivated and participate quite actively in the class. However, the same cannot be stated for the next class offered. Advanced Placement United States History, -1/2 credit elective. This course is designed for students to earn high school and college credits simultaneously, using the convenience of computer technology. College credit will be awarded upon successful completion of the Advanced Placement Exam for AP US History. Debbie Anderson is the instructor of this course and for reasons unknown, the majority of her students are not doing well. As a matter of fact, on the very day that I interviewed Allen Cole, he was preparing letters to the parents' of students who were failing this course. The wonderful thing about this program being a pilot project is that there is an "out" for students who do not excel in this electronic style of learning. These students are offered the opportunity, even at late dates in the semester to drop a course with no penalties rather than scar their permanent academic record. Cole isn't sure if it is the instructor's inability to transform her traditional teaching style to one that is compatible to the Internet or if it is the subject matter that makes this class difficult to grasp. "Perhaps it is simply that some people cannot learn adequately via the Net," he asserts. Cole agrees that extensive human computer interaction research should be taking place simultaneously to the development and implementation of this pilot program. I have offered myself for that study. The other classes offered to date via the Electronic School are: Geometry B -1/2 credit, Mathematics Requirement. The prerequisites are a C in Algebra IB and Geometry A or the consent of an instructor and pre-screening interview and testing. Other courses are Global Studies -1/2 credit Advanced Guidance -1/2 credit elective and Entrepreneurship -1/2 credit elective. This course sounds fun. It is an introduction to entrepreneurship with a unique look at the relationship to the Hawaiian culture and values. Students will have an opportunity to take "electronic field trips" to local businesses, meet entrepreneurs from the community and learn first-hand about marketing strategies, market research, competition in the marketplace, organization of a business, etc . . .

The Office of Advanced Technology Research snail mails registration forms as well as sends them via email to all of the participating schools in the districts. Students may respond via email fax or snail mail. There are requirements in order to participate in the program. Those include viewing course during air time (TV with cable access required), access to computer and Internet in your study area, successful completion of course assignments and requirements, access to a phone line during broadcast times, "video release" and "parental consent" forms and finally compliance with the Acceptable Use Policy for DOE Internet Services, which is written by each school. Each school that participates in the program is required to have a School Site Coordinator (teacher). This would be the computer literate technical person that could support students with projects (Internet or creative dramatics), help students as needed (access of equipment, resources, provide encouragement to students and file permission forms. Hawaii's Education & Research Network (HERN) has agreed to train teachers and staff to be able to perform these tasks. David Lassner contends that HERN will offer moral and technical support by conducting workshops. The DOE also has initiated a program called T3: Technology & Telecommunications for Hawaii's Teachers.[17] This course is offered via the Internet. The program's goals are to prepare DOE inservice teachers for leadership technology positions in their schools, to infuse appropriate technology and training into the curriculum and to develop a network of people resources to provide assistance to schools.[18]

Technical Problems

Allen Cole admits the pilot project has its share of technology problems. The first and far most is the natural growing pains of creating and implementing a telecommunication-based learning program. He offered me an itemized list of current problems: Not all of the schools are currently wired. This takes manpower, money and strategic planning. Not everyone has the technical knowledge to use the system. Basically, Cole claims not everyone currently connected is computer literate. This creates slow "snails" pace progress. "But this is why this is a pilot program, to work these things out and train people," he professes. There are not enough teachers to create the on-line courses and some of those who do create courses cannot adapt their teaching styles for this media. Perhaps, this is one reason why the AP US History courses is doing poorly.

Many of the On Site School Coordinators do not truly understand the nature of their job. Cole believes that the concept of the Electronic School will eventually become like the ATM Card and the Versateller machines. Many people did not understand how to use the machines and were afraid to use them. Now everyone and their grandmothers have ready teller cards and access the machines frequently. So will be the case with information technology he predicts. The program has not yet purchased the equipment or software for (IRA) InterRelay Chat or real time video conferencing. This has prohibited their video conferencing via the Internet. Once the server has been purchased there is another dilemma of hiring someone with the proper skills to set it up and operate it. Other common problems that Cole projected were bandwidth, faulty or incompatible equipment at either end of the telecommunication process and the possibility of a shortage of future storage space.

A suggestion to Mr. Cole's problem regarding not enough teachers to write curricula for on-line classes is the utilization of the current on-line classes available at the University of Hawaii. A newly designed classes by Jan-Michelle Sawyer, Applied Organization Communication would be ideal for high school students to audit or to participate without risk. Another on-line discussion group that would possibly prove fruitful for the pilot project would be the Capti-l (NEH) pluralism listserve. This would be enlightening for students taking U.S. History. Cole could solicit the help of graduate students and professors to help create interactive and informative on-line courses. This would help to create a much needed bond between the DOE and higher learning institutes that David Lassner spoke about.[19]

CONCLUSION AND RECOMMENDATIONS

Although there are some information technology complications surrounding the Electronic School project they are not enough to drench the enthusiasm of the creators of this program. Marsha Mooradian wants Hawaii's students to become HI-Tech, so that the world looks to Hawaii as a center of advance information technology rather than just a recreational spot.
As a one who is intrigued by information systems and its impact on the education industry, I am encouraged, even excited about what I have seen. The program is only one semester-old and has great potential. I am eager to access the program's growth and future maturation. I have inquired about the assessment and evaluations processes currently in place. Marsha Mooradian assured me that there are some assessments in place, such as WASC and ICSAC.

Recommendations for assessments of the pilot projects are:

- A longitudinal(HCI) study to examine the cognitive learning sytles of the students involved in the project. This study could also compare cognitive learning styles and/or success rates of students not participating with those who are participating.
- An ethnographic case study or studies of particular students who are instructed in specific course in this project.
- A human computer interaction (HCI) study involving cross tabulation. The study would be designed to detect the information processing of individuals or groups of students involved in the project.. Such independent variables can be, gender, culture, age, interests.
- An exploratory human-computer interaction study to determine the relationship between "micro-computer playfulness"[20] and the End-Users Adoptiveness of Information Technology. This study would involve measuring the technology adaptability or acceptance of the Internet by the subjects (teachers and/or students) of the pilot project and the effects of the electronic format upon individuals involved.

These recommendations are made to suggest future research in the area of information systems and education but most importantly to help evaluate a worthy program, the Electronic School.

My final recommendation is to encourage the creators of the Electronic School project to remember that computer technology in the classroom will not solve all of education's ills in an instant. Please remember that the technology should be used as a tool to complement traditional teaching methods and not as a weapon to destroy it. My fear is that students will not be well guided through this venture and will allow the technology to use them. Remember that the absence of the Internet in Hawaii's public schools was only part of a larger problem, therefore its presence will not be the total cure all.

ENDNOTES

1. Theodore Roszak, *The Cult of Information: The Folklore of Computers and the True Art of Thinking* (New York: Pantheon), 62-63, 1986.

2. Neil Postman, *The End of Education: Redefining the Values of School* (New YorkL Knopf), 1995.

3. The Politics of Education. (1992) P. 15 Sven Groennings, Education Adviser, American Express. School Reform: Business, Education and Government as Partners. Edited by Theresa Brothers. New York: The Conference Board.

4. The Roles of the New American Schools Development Corporation. (1992) p.17 School Reform: Business, Education and Government as Partners. Edited by Theresa Brothers. New York: The Conference Board.

5. Kristine Woodall is a Global Communication Master's Degree candidate at the University of Hawaii at Manoa. (1996)

6. This report consists of selected speeches from The Conference Board's 8th Annual Business and Education Conference, held in Chicago, Illinois, on March 19, 1992. A copy of this report may be obtained from The Conference Board, 845 Third Avenue, New York, NY 10022.

7. Joe Kincheloe, Clemson University. This quote was taken from a chapter he wrote entitled, "Exposing the Technocratic Perversion of Education: The Death of the Democratic Philosophy of schooling. Found in a the book, The Socio-Culture Foundations of Education and the Evolution of Education Policies in the United States. Edited by James Van Patten. 1991. Published by Edwin Mellen Press: New York.

8. Diane Ravitch, "When School Comes to You," The Economist, September 11, 1993, 45-46.

9. Hugh McIntosh, National Research Council News Report, Summer 1993, 2.

10. For more information contact: netday@netday 96.com

11. Emma Pavich, counselor. The Honolulu Advertiser 11/26/1996, "On Schools" column Section B, p.1.

12. Andy Carvin. 1996 EdWeb: Exploring Technology and School Reform. (http://k12.cnidr. org:90/resource.cntnts.html)

13. Marsha Eileen Mooradian, is the Public Affairs Coordinator for Maui Hi-Performance Computing Center, MHPCC, she was funded by MHPCC to create Tech Corps Hawaii.

14. Tech Corps Hawaii is a volunteer organization, who members advise and assist schools in the introduction and integration of new technologies into the educational system. Tech Corps Hawaii is a branch of the national nonprofit Tech Corps which has been organized in over 40 states.

15. Inside the Electronic School - http://www.k12. hi.us/~eschool

16. ATR's URL address is http://www.k12.hi.us/ ~atr

17. Telecommunication for Teachers Homepage: http://www.k12.hi.us/~tethree/

18. More information on these and other programs offered by the DOE can be found by accessing the Department of Education's Homepage at: http://www.k12.hi.us/

19. See David Lassner's paper, "Partnering with K12: A Statewide Approach" at http://cause-www.colorado.edu/information-resource/ir-library/abstracts/cns9616.html

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Marsha Eileen Mooradian, is the Public Affairs Coordinator for Maui Hi-Performance Computing Center, MHPCC, she was funded by MHPCC to create Tech Corps Hawaii. Tech Corps Hawaii is a volunteer organization, whose members advise and assist schools in the introduction and integration of new technologies into the educational system. Tech Corps Hawaii is a branch of the national non-profit Tech Corps which has been organized in over 40 states.

ATR's URL address is http://www.K12.hi.us/~atr
T3: Telecommunication for Teachers Homepage: http://www.K12.hi.us/~tethree/

Department of Education's Homepage at: http://www.K12.hi.us/

THE GRADEBOOK AS A SYSTEMS ILLUSTRATION IN THE PRINCIPLES OF IS

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Freshman and sophomore business students do not have a great deal of first-hand experience with computer-based information systems (CBIS). In order to help them develop an understanding of such systems, the instructor should attempt to find some link to the student's world that can be used as a learning vehicle. Students understand grading. They have been on the receiving end for some time. They know that:

- the instructor has a responsibility to capture data regarding their graded activity -- exercises, tests, etc.;
- they are periodically provided with grade information in order to assess their progress, and;
- in light of their personal goals, they employ grade information to make decisions regarding allocation of their time and effort between competing uses -- jobs, other classes, recreation, sleep, etc.

In other words, students and teachers share grading as a common experience in information systems. This common experience can be a vehicle useful for learning a variety of basic information systems concepts.

TRANSACTIONS PROCESSING

Historically, and from the instructor's perspective, grading exhibits the characteristics of transactions processing. Recording and tabulating student scores has traditionally been done manually using notebooks formatted for that purpose. As an illustration, it is useful to bring one of these spiral bound books to class and pass it around for student's to look at. More recently, as personal computers became available to instructors, this processing has become automated. Teachers value the opportunities for cost reduction (in terms of their time) and the enhanced accuracy provided by computer-based grade recording and processing. In view of the size of the market, commercial applications (i.e. grading software) have proliferated.

Moreover, in step with current trends in transaction processing, a gradebook may be readily implemented as a relational database application. The relational features are enriched when cooperative learning techniques are employed in the class. In this context, since it is necessary to record and process transactions of learning groups as well as individual students, both student and group tables are required. This offers the opportunity to illustrate the essential features of relational data modeling and database design. In this regard, the following figure serves as a meaningful example of how foreign keys serve to link tables in a one to many relationship.

Group Table

Pri. Key	Att. 1		Att. N
GroupID	Test1Bon.	...	Project
01	5		94
02	4		87
...	...		...

Student Table

Pri. Key	Att. 1 ...	Att. N	For. Key
SSN	Ex1	Test3	GroupID
7548	15	130	08
6043	13	128	12
...	...	...	...

From an organizational perspective, one can contrast decentralized, PC-based instructor systems with legacy systems employed by the college/university to manage student-related data such as student demographic information, class lists, and course grades. The nature of the interface between these systems, and especially instructor access to organizational data, provides insight into current trends in enterprise computing.

INFORMATION REPORTING

The existence of stored data on student/group characteristics and performance allows for feedback to students in preformatted reports. This lends itself to an examination of information reporting systems or management information systems (MIS), in the traditional use of that acronym. These reports (i.e. performance summaries) are formatted for an individual student and are provided after each test. Since they are cumulative, they provide up to date information on current grade status -- a matter of substantial interest to the student.

The design of these reports as a communications tool customized to the grading scheme of the instructor and informative to the student, is an important issue. Aside from providing an opportunity for discussion of design factors, and an illustration of the use of a database report generator, an additional benefit is the manner in which they serve to clarify that grading scheme in the eyes of the student.

DECISION SUPPORT

The gradebook also provides an opportunity to illustrate the design and use of decision support tools. The formation of learning groups early in the academic term presents an opportunity to illustrate data-oriented decision support. Proponents of cooperative learning suggest that teacher-made learning groups produce better outcomes since the instructor is in a position to maximize the heterogeneity of the students in a group. Student characteristics to be considered in forming heterogeneous groups include academic ability, gender, ethnic background, age, and major. Of these, academic ability is especially important.

The first issue to bring to the student's attention is data access. Data on these student characteristics are typically stored on the college/university administrative computing system. While the link to administrative data will differ between institutions, most schools provide faculty with some access to the organizational database. Currently, our institution provides instructors with a download capability (via the campus network) for selected student characteristics by course and section in text delimited format. These data may then be imported into a student table.

Secondly, once the data are in the table, it requires some processing into information to support the group formation decisions. This processing problem can be presented to the students. If they were in the instructor's position, how would they process it given the objectives in mind with respect to group formation? In this case, the use of simple data management tools such as sorting can be highlighted.

Model-oriented decision support may also be illustrated in a gradebook context. Time is especially precious to students toward the end of the academic term. At that stage it is not uncommon for the instructor to be asked "what if" questions by the students as they make decisions based on their perceptions of the marginal benefits of alternative uses of their time -- e.g. "What do I need on the final to get an A"? A simple spreadsheet-based DSS can help the students with their very real decisions and also serve to illustrate some basic decision support concepts and associated features of modern spreadsheets.

The spreadsheet range shown above is the first page of a spreadsheet DSS available to the students. The instructor's grading scheme serves to define the models. Predicted student grade is the critical result variable. The initial data input (known grade data) can come directly from the student's most recent performance summary. The parameters to be manipulated are exercise, test, etc. scores that are currently unknown. Two models are useful. The first model (PASTPERFMOD) employs initial data to identify historical percentages for student or learning group performance in specific grade categories (e.g. tests, exercises). These percentages provide guidance to the student in formulating a baseline scenario for the unknown parameters. Once the student provides a parameter set, a second model (GRADEMOD)

GRADEDSS.XLS Bill Wehrs 4/23/97

This spreadsheet DSS may be employed by MGT 220 students to project their semester grade. It also provides a preliminary illustraton of a spreadsheet DSS designed according to "Goodform" principles.

To employ GRADEDSS:

1. Enter known grade data (See Performance Summary report) into initial data;
2. Use past performance %'s to make assumptions about grade data that is yet to be determined;
3. Make assumptions about group and instructor factors; and
4. Display or print the What If report to see the grade projection.

Reference: MGT 220 Syllabus, Performance Summary: After Test 2

Contents/Map: (Sections are on a separate sheet and subsections are named)

INTRO	Introduction: Title, description, contents, and map.	
INITIAL	Initial data and beginning assumptions	
MODELS		
	PASTPERFMOD	Past Performance % Model
	GRADEMOD	Grade Projection Model
REPORTS	What If Report	
GRAPHS	Past Performance by Grade Category	

employs the initial data and the parameters to predict the student's grade. A baseline scenario predicts their semester grade if historical norms hold in the latter portion of the course. Of course the student is free to examine scenarios of his/her own choosing.

In addition, useful decision support features in modern spreadsheets can be showcased. For example, the "What do I need" question is a goal-seeking issue. In this case a student employs the goal-seek feature to determine a final test score that yields the point total commensurate with a grade goal. The spreadsheet-DSS may also be employed to do sensitivity analysis. This type of analysis is especially useful for examining the impact of parameters not directly under the control of the decision-maker. With cooperative learning, a student's grade is influenced by the evaluation of his/her learning group peers. Consequently a data table may be employed to examine the relationship between the student's semester grade and alternative peer evaluation scores.

OTHER BENEFITS

In addition to direct instructional benefits, there are other benefits associated with the gradebook. One such benefit might be called its "missionary" use with our non-IS (Information Systems) colleagues. One of the goals of our institution is to implement vertical linkages in the business curriculum. For IS this means a tools-based linkage between the Introductory IS course and subsequent upper division business classes. However, we find that upper division non-IS faculty tend not to employ database technology as part of the toolkit they expect of their students. A major factor in this is their lack of familiarity with relational database management systems. Pursuing the common experience theme, grading is also a common experience between IS faculty and non-IS faculty. A grade database can be a "foot in the door" in persuading other faculty to become familiar with database technology and employ it in their classes.

Another benefit lies in learning assessment. Assessment is currently a major theme at many colleges and universities. Such assessment can take place in a variety of ways. One approach is to employ statistical techniques. If an instructor takes this approach, a gradebook implemented as a relational database can be a valuable framework to accumulate the data to be statistically processed. Not only are the student grade data (such as test scores) valuable, but in a non-experimental statistical context, the data on student characteristics are necessary as well.

OFFERING A CROSS-DISCIPLINARY MINOR

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We have recently implemented a cross-disciplinary minor in Information Technology. The minor requires 15 credit hours of course work from our current Information System curriculum, and is offered to majors in any discipline. Some aspects of the curriculum have been adjusted to meet needs of non-IS and non-business students. The 3 required courses (9 credit hours) provide a solid foundation in Information Technology, while the 6 hours of electives allow the student to appropriately diversify their learning experience. Results so far have been encouraging with benefits to students in general, as well as IS majors, faculty, and the department as a whole.

INTRODUCTION

We have recently implemented an Information Technology (IT) minor to compliment our Information Systems (IS) major and Management Information Systems (MIS) concentration for the MBA program. These programs are offered through the Department of Accounting and Information Systems from the College of Business Administration. The IT minor can be applied to any major in any of the University's three colleges -- Business Administration, Arts and Sciences, or Social Sciences.

Before formally offering the minor, we interviewed faculty from several disciplines and found interest from all of the business areas and most of the social science areas. The hard sciences, such as Physics and Chemistry incorporate their own specific computer related technologies within the curricula and are less interested in the information technologies.

The minor is designed to support another discipline and not to provide an avenue for career change to the IS profession. The minor was labeled "Information Technology" to differentiate it from the IS major which does prepare a student for entry into the IS profession.

CURRICULAR DESIGN

The minor consists of 5 or 6 courses making up 15 semester credit hours. Our IS major requires only 21 credit hours because of heavy core requirements in business and for the University liberal arts core. Three courses, three credit hours each, are required for the minor -- an introductory course in Management of Information Technology, which is required for all business majors, a Hardware/Software Overview course, and a Data Modeling and Management course. The other six credit hours are elective. No programming is required, although programming courses may be taken as electives, and students are exposed to programming concepts in the data modeling course.

Required Courses

The Management of Information Technology course is a traditional introductory course for business students. Students are required to come into the course with a basic understanding of microcomputers and their use, with the ability to effectively use a word processing software package. The course provides an overview of the IS discipline, including hardware/software technologies, data communication and the Internet, data modeling, system development, and ethical/societal issues. The hands-on portion of the class, concentrates on data modeling using spreadsheet and database tools (Microsoft Excel and Access). Introductory lessons with hands-on instruction for using e-mail (Eudora Lite), Internet tools (Netscape Navigator), and presentation tools (Microsoft Powerpoint)are also included. This course is pre-requisite to all other courses available for the minor except the World Wide Web course and discipline-specific courses.

The Data Modeling and Management course extends significantly from material covered in the introductory course. Emphasis is placed on the data modeling process with Microsoft Access used as a modeling tool. The reasoning behind making the course mandatory for minors was twofold. First of all, since a data base is at the heart of most all applications regardless of discipline, students should understand the process in order to better utilize available data. Secondly, data base tools such as Access, are probably the least well understood of the standard office productivity tools. This course is also required for IS majors and a similar course is offered as an elective at the graduate level.

The third required course, Hardware/Software Overview, has been a popular elective for IS majors, and a graduate version of the course has been well-attended by MBA students over the past several years. Approximately half of the course concentrates on hardware specifics with emphasis on PC components. Components on Macintosh computers,(RISC Workstations, mini and mainframe computers) and networking concepts are also included. The software segment covers various operating systems including DOS/Windows, Windows 95 and NT, OS/2, UNIX and the MacOS, as well as a basic overview of proprietary mini and mainframe operating systems. Other software components include application and productivity tools, system utilities, educational software, and software/system development tools. This course was determined to be mandatory status for minors because it provides in-depth study of key computer technologies being used to support applications across multiple disciplines.

We feel that these three courses provide a solid grounding in information technology to adequately support both business and non-business majors.

Elective Courses

Current electives from which students can choose, include Data Communications and Networking, Contemporary Issues in IS, Introduction to Structured Programming (Qbasic and Visual Basic), Programming for Modern Business Applications (COBOL and C++), Advanced Programming (COBOL or C++), World Wide Web Fundamentals, Systems Analysis and Design and the Senior Project. Non-business majors generally do not have the pre-requisites for the Analysis and Design and Project course, but can be admitted with permission of the instructor. Students can also take courses from within their own disciplines if the course has a significant IT content.

While no minors have yet taken the more advanced programming courses, several have enrolled in the introductory programming course which has a heavy emphasis on Visual Basic. Others have chosen the networking course and the contemporary issues course. There is currently one minor enrolled in the Analysis and Design/Senior Project sequence. The World Wide Web course will not be offered until Spring, 1998, but we anticipate a heavy attendance by non-IS majors. A graduate version of this same course has been in heavy demand by MBA students from all disciplines in the College of Business. Given the current popularity of the Web, we hope that this course might attract students to the IT minor.

Course Planning Considerations

While our courses have been traditionally oriented toward the business disciplines, we have found that much of our course material is more generally applicable to a wide variety of majors. We have made an attempt to individualize work in some of the classes so that students can gear projects to their own discipline. We are designing the Web course so that one third of the course time will be flexible to suit varying needs. Some students may concentrate on more technical aspects of the Web, such as Java programming and scripting, while others may concentrate on advanced design tools and techniques, and a third group may work with groupware or advanced database searches. Students can further diversify their course work from the standard curriculum by pursuing independent study. For instance, an accounting student might work with an accounting software package, or a marketing major might work on marketing aspects of the Web.

We do not encourage independent study because of the increased strain on resources. However, we have found it necessary at this time, until we can increase our course offering with increased enrollments and modify other courses to more effectively target non-IS majors without sacrificing service to our own majors.

OBSERVATIONS AND CONCLUSIONS

We have completed our first full year offering the minor, and considering the fact that we have done very little marketing of the program other than through word-of-mouth, the results have been encouraging. We currently have minors enrolled from several of the business disciplines, as well as from our generalized Liberal Arts degree offered out of the College of Arts and Sciences. Overall, for the Spring of 1997, there were 8 officially declared minors -- 4 Liberal Arts, 2 Accounting, 1 Finance, and 1 Communications major. For the Fall of 1997, there are 9 students in all -- 5 Liberal Arts, 1 Accounting, 2 Finance, and 1 Management. There are also a number of other non-IS students currently enrolled in IS classes who have not officially declared the minor. This compares favorably with a current enrollment of 57 IS majors.

This increased enrollment for individual classes provides multiple benefits. Having a more diversified student population in our classes has been positive for both students and faculty. It often provides a less technical perspective for many of the IS "techies", and it forces faculty to consider the less technical "user" perspective as appropriate. Students who add the minor to their already heavy load are generally highly motivated and help to stimulate active discussion on class materials.

Anecdotal feedback with regard to specific courses and the program in general has been quite positive. We intend to more actively market the program, especially to non-business majors. We hope that the Web course will attract from outside the college. We are offering the class without the typical introductory course as pre-requisite. However, we will insist that students have a firm grasp of basic microcomputer skills before taking the course.

Overall, we have been quite satisfied with the program. We are attracting quality, motivated students from multiple disciplines. We feel that this has increased the general quality of our courses, with minimal changes to our regular course offerings. It definitely appears to be a win/win situation for students and faculty.

EVALUATING INFORMATION SYSTEMS CURRICULUM MODIFICATIONS: USING A PILOT PROGRAM

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EXTENDED ABSTRACT

In order to update the undergraduate Information Systems curriculum, a core course was revised. The 14 week course became two 7-week long modules. Several other core courses in the curriculum were also introduced as 7-week modules. Students enroll in some 14-week courses and some 7-week courses during a regular semester. They still are taking 12-15 credits, but are taking more courses. One 7-week course ends in the middle of a semester and another 7-week course begins. Therefore, a student with 15 semester credits, with 2, 7-week modules, actually attends 6 different classes during the 14 weeks, but only has 5 courses at any given time.

Before exposing the whole student body not only to new courses, but to a new scheduling structure, the new curriculum was tested or piloted on a select group or cohort of students. These 60 students, comprising 2 cohort sections, either volunteered for the program or were invited to participate in the program. New software was introduced, exercises were used to enhance critical thinking abilities and participation during class was very high. The students rose to the challenge of more advanced material and developed extremely mature writings and projects. They were constantly challenging the instructors.

After successfully testing the new courses with the new structure, the courses were then taught the following year to everyone in the business school. The same instructors using the same methods were responsible for the courses. Many issues arose that did not surface during the pilot semesters. There were complaints about the amount of out-of-class tasks and the level of difficulty. Participation during class was minimal and the quality of the assignments diminished. Additionally, the transition period in the middle of the 14-week semester, from one module to another caused tremendous confusion. After several repetitions with non-cohort students, there is little, if any, improvement.

This research attempts to look at the feasibility of using a cohort group that self-selected or was hand-picked to test out new and challenging concepts. The cohort students were different because they volunteered or were noticed enough to be invited to participate. They were leaders both academically and socially. Did they present a true representation of the effectiveness and issues within the new course? Did they set new/high (too high) standards for the course that the rest of the student population cannot live up to? Would randomly selecting a section of the course produce better results? Would not a Hawthorne effect still be present? Is there anyway to really test a new curriculum with a subset of the student population as the cohort students were different from the student body population? Is it better to use the whole student population?

DEVELOPING A COMPUTER INFORMATION SYSTEMS CURRICULUM BASED ON AN INDUSTRY NEEDS SURVEY

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This paper details our experiences in developing an undergraduate Computer Information Systems (CIS) curriculum at a small liberal arts school. The development of the program was based on the study of needs assessment. Findings were based on the analysis of four sources of data: the result of an industry needs survey, the data from the ICAPP needs assessment project, the Georgia Department of Labor data, and the US Bureau of Labor Statistics: The task of developing the CIS program was broken into six phases namely, performing needs assessment, defining goals and objectives of the program, identifying CIS curriculum guidelines and other sources of feedback, planning for human and equipment resources needed for the program, studying target students, and developing the curriculum. Details of the curriculum and its characteristics are presented and compared with other similar curriculums.

INTRODUCTION

North Georgia College & State University (NGCSU) is a small liberal arts institution. In January 1997 the authors were given the opportunity to develop a CIS curriculum. Frequently, university programs in CIS are offered in the school of business, school of management, or school of applied technology. At our school, the CIS curriculum was to be developed by the authors who are faculty members of the department of mathematics and computer science. In a small college such as NGCSU with limited resources the collaboration between departments in program offerings is necessary. Thus the program is to be offered jointly by our department and the Department of Business Administration and in collaboration with a two-year college in a neighboring community. The task of developing the CIS program was broken into six phases as described below.

The purpose of the first phase was to establish needs for a CIS program at our school. Statistical data that supported the need for a CIS program was needed. These data were provided from four different sources: the result of a survey questionnaire which was sent to a number of private businesses and government agencies, data from the ICAPP needs assessment project of the University System of Georgia, the Georgia Department of Labor occupational projection until the year 2005, and the US Bureau of labor statistics occupational projection until 2005. This data supports the need for CIS graduates both locally and nationally.

After completing a needs analysis, the goals and objectives of the program were defined. Model curriculums and curriculum guidelines were also studied. In developing a Computer Science curriculum, one can use the national standard guidelines ACM/IEEE computing curricula 1991 (Tucker et al., 1991). However, for a Computer Information Systems (CIS) program, also called Management Information Systems (MIS), or Information Systems (IS) no national standard guidelines are available. Excellent efforts to establish a national standard guideline for CIS programs appear in several publications including, Management Information Systems Quarterly, MISQ (Couger et al. 1995), DATABASE (Gorgone et al., 1995), the report of the joint ACM/AIS/DPMA Task Force (Longenecker et al., 1996 & 1997), and the Office System Research Journal, OSRJ (Caouette et al. 1996). These articles provided useful information in shaping the curriculum. In addition catalogs and web pages from schools across the country as well as all schools in the state of Georgia that are offering CIS program were reviewed. An additional survey was sent to heads of departments of schools offering CIS programs in the state of Georgia.

The fourth phase of development addressed human and equipment resources needed for the program. For this phase a five year plan has been proposed which includes hiring additional faculty with terminal degrees. Also an assessment of the hardware and software resources needed for the program has been established. The fifth phase focused upon the identification of target students, the sole consumers of the program.

The sixth and final phase of the project resulted in the CIS curriculum which was developed using the goals and projected resources mentioned above. The main characteristics of our curriculum includes a direct relation to industry needs, incorporation of multimedia technology, internship program, application of www in CIS, and use of CASE tools for hands-on applications. Also, the program is designed with enough flexibility to accommodate the non-major course requirements from a CIS curriculum. It is also constructed to attract industry employees who may need to update and enhance their knowledge and skills. In the following sections different phases of the development of the CIS curriculum are explored further.

NEEDS ASSESSMENT FOR A CIS PROGRAM

The needs assessment findings were based on the analysis of four sources of information: the result of an industry needs survey, the data from the ICAPP needs assessment project, the Georgia Department of Labor data, and the US Bureau of Labor Statistics. These four different sources of data are described in the following subsections.

Needs Assessment Survey

In March 1997 we conducted a needs assessment survey locally in the mountain and metropolitan Atlanta area. The survey questionnaire was sent to 400 private businesses and government agencies. Of these, 87 percent were private businesses and 13 percent were government agencies. Approximately 20 percent of the companies surveyed responded. The survey questions were carefully designed to serve two purposes. First, to identify the needs for the establishment of the CIS program at NGCSU. Second, to provide technical data that will be used for the development of the curriculum. The result of the survey reveals that over 50 percent of the respondents need CIS graduates. Also over 21 percent indicated that their current CIS staff need additional technical training. Table 1 shows the total number of CIS graduates needed in the area of our survey.

TABLE 1

NUMBER OF CIS GRADUATES NEEDED FOR THE AREAS OF OUR SURVEY

Period Of time	Total demand	Total supply	Unmet need
in 2 years	289	140	149
in 5 years	1043	350	693
in 10 years	1448	700	748

ICAPP Needs Assessment Project

The March 1997 Supply-Demand Analysis of the University System of Georgia under an ICAAP needs assessment project reported a number of interesting data. The report indicates that the largest cluster of occupations with unmet needs, are computer related professionals. Table 2 shows the degree of needs for CIS related graduates.

Georgia Department of Labor Occupational Projection

The occupational supply and demand data contained in the occupational projection until 2005 that has been prepared by the Georgia Department of Labor shows the annual need for the CIS related graduates. These data appear in table 3.

TABLE 2

DATA FROM ICAAP NEEDS ASSESSMENT PROJECT OF THE UNIVERSITY SYSTEM OF GEORGIA, UNTIL THE YEAR 2005

Specialization	Annual demand	Total supply	Unmet need
Systems Analysts	1,010	733	277
Computer Programmers	700	101	599
Computer Engineers	373	110	263
Computer Programmer Aids	138	22	116

TABLE 3

GEORGIA DEPARTMENT OF LABOR OCCUPATIONAL PROJECTION

Occupational Title	1994	2005	Total change	Percent change
Systems Analyst	11,720	27,650	15,930	135.9
Database Administrators	750	1,630	880	117.3
Computer Support Specialists	1,580	3,360	1,780	112.7
Computer Programmers	12,980	18,200	5,220	40.2
Computer Programmer Aids	3,180	3,890	710	22.3
Programmers: Numerical Tool	80	90	10	12.5
All other Computer Scientists	1,930	5,240	3,310	171.5

This data indicates that in 1994 over 32,200 jobs were available in computer and information science occupations in the State of Georgia. By 2005, this number is estimated to grow to over 60,000. The Georgia Department of Labor reports that systems analyst is currently the second fastest growing occupation in Georgia.

US Bureau of Labor Statistics

Our needs assessment findings were consistent with the US Bureau of Labor Statistics forecast for occupational growth (Couger et al. 1995). This data is shown in table 4 below :

TABLE 4

BUREAU OF LABOR OCCUPATIONAL FORECAST

Area of specialization	Percentage of growth
Computer Engineers and Scientists	112%
Systems Analysis	110%
Physical Therapists	88%
Special Education Teachers	74%

The data indicates that there is a great demand for CIS graduates both within the state and nationally. Once we were convinced that the CIS program was needed, we proceeded with other phases of developing the CIS program. These are the subject of the following sections.

GOALS AND OBJECTIVES

The motivation for the development of the CIS program was twofold. The first was a concerted effort to reallocate resources and restructure programs to better meet the needs of both students and industry. A second factor was the projected employment opportunities for CIS graduates. Based on the needs analysis, it is expected that students with a degree in CIS will have greater employment opportunities than students with a major in business management.

The goal and objective of the CIS program was defined as "preparing graduates who are capable of using information technology for data acquisition, communication, coordination, analysis and decision support." Additional objectives of our program included fulfilling the general course requirement of our school and maintaining enough flexibility to accommodate the non-major course requirements from the CIS curriculum. The program needed to be attractive to students desiring CIS as their minor and to students in both the Mathematics/Computer Science and Business Administration departments of our school. It was also important to make the program attractive to industry employees for the purpose of enhancing their knowledge and skills. Although the program is aimed for local businesses, there is no guarantee that graduates will not accept jobs in other parts of the country. For this reason, we designed the curriculum to be consistent with employment needs across the country.

CURRICULUM GUIDELINES

In the development of the curriculum several curriculum guidelines were used, these include:

- Nationally published curricula guidelines such as ACM, AIS, DPMA, OSRA, DATABASE, MISQ. These guidelines provided excellent sources of input and were useful in shaping a more global view of the CIS curriculum. They served as a foundation for the CIS curriculum and were adapted to meet our needs and resources. They also, we hope, will convince our administration to obtain adequate human and equipment resources for the program.
- The technical data gathered from the industry needs survey.
- The results of another survey questionnaire sent to the department chairs of some schools offering CIS programs were used to identify strengths and weaknesses of other programs.
- Catalogs of twenty-four schools in the state of Georgia offering a Bachelors or an Associate degree in CIS, as well as, catalogs from some reputed CIS programs nationwide were used to provide information about curricular requirements of other programs.
- Web pages of some schools offering a CIS program specifically helped us review course syllabi and course contents. These data were helpful for preparing the course contents for our program.
- Feedback received through electronic mail from our colleagues at other schools with similar program in the state of Georgia were also useful.

RESOURCES

To offer a successful program it is necessary to provide adequate human and equipment resources to support the program. Since the computer industry is progressive and changing rapidly, it is necessary to remain competitive through use of up-to-date technology and resources. A five year plan has been established for the program, starting Fall 1998. The schedule for the number of students entering the CIS program is shown in Figure 1.

FIGURE 1

PROJECTED NUMBER OF STUDENTS ENTERING THE CIS PROGRAM

Year	Number of Students				Total
First	20				20
Second	20	20			40
Third	20	20	20		60
Fourth	20	20	20	20	80

The result of our needs assessment also indicated a strong need for minors in CIS. On average if we expect to have ten minors per year then the total number of students for each CIS class would be twenty-five to thirty.

Human Resources

Following MISQ recommendation (Couger et al. 1995) the number of full-time faculty needed by a program is influenced by many factors such as number of students in the program, the number of required courses, the number of service courses and elective courses offered, and the teaching load of the faculty. Currently, faculty teaching load at NGCSU is 15 quarter hours. During the Fall of 1998 when the CIS program is planned to start, the teaching load is expected to be 12 credit hours per semester. The total number of additional faculty needed for this program is anticipated to be four. These faculty need to be hired one per year, starting Fall 1998 and some positions may be obtained through redirection of existing faculty from mathematics or business. Over the five year period of 1998-2002 a total of four faculty with terminal degree in Computer Information systems will be required. In addition it is predicted that a technical lab assistant for hardware maintenance and support will be needed.

Equipment Resources

To remain competitive a program must use up-to-date technology consistent with industry needs. Over a five year period, the equipment requirements for the program, based on the analysis of needs assessment, is listed below.

- state-of-the-art labs with sufficient number of Pentium computers or workstations running both Unix[1] and Windows based Network.
- Classrooms equipped with multimedia technology, sound system, and group support systems.
- CASE tools for object_oriented and structured systems.
- Graphical User Interface (GUI) environment.
- Visual Programming Languages.
- DBMS application software running on Microcomputers and for Workstations.
- A five year plan to upgrade equipment.

TARGET STUDENTS

It is important to identify the target students, the major consumers of the program. In this study the target students are students who are interested in application of computers in business. These students come from different backgrounds and, generally, are interested in computers, business administration, or both disciplines. Students entering the program can expect to pursue careers that are both challenging and rewarding. Although the job market should remain lucrative for the information industry, it is also demanding in time and study resources of those who decide to follow this career path. These issues are important and should be addressed in classes. It helps to make students aware of the relation of the subject area and industry demands. Because of the high employment forecast for CIS graduates, we are also anticipating to attract students from such majors as physics.

CURRICULUM

In this section we present the CIS curriculum for both the major and the minor. The major is designed to foster the development of graduates who have the ability to analyze, design, and develop business oriented systems, while the minor is designed for students who wish to combine CIS expertise with another major. The industry demand for CIS graduates was a strong factor in shaping our curriculum. It includes a variety of courses for students in many disciplines. CIS majors must elect courses from both Math/Computer Science and Business Administration. Thus, we believe, the CIS program has a strong foundation in both Business Administration and Computer Science. A list of the courses in our CIS program is given below. The first 44 credit hours are general college requirements that every students must take regardless of major. The courses specific to our major are listed in table 5.

CIS Major Requirements

The course requirements for CIS major are listed in table 5.

Students can choose 15-18 credit hours from other disciplines as a minor and the remainder from elective courses listed above to add up to 24 credit hours.

CIS Minor Requirements

Students who elect to take a minor in CIS must take all six courses listed under Courses Appropriate in Major Field listed above, plus four additional courses from the CIS Major Degree Core Courses numbered 3000 and above.

TABLE 5

CIS MAJOR COURSE REQUIREMENTS

Course name	Brief description	Suggested year
Computer Science I & II	Computer Concepts & Object Oriented Programming (OOP)	Freshman & sophomore
Object Oriented Systems	Advanced OO Analysis and Design	Sophomore
Principles of Macroeconomics	Intro. To American capitalism, employment theory, fiscal policy, money & banking	Sophomore
Principles of Financial Accounting	Theory and application of managerial accounting concepts	Sophomore
Business Information Systems	Application of word processing, electronic spreadsheet, and database management principles	Sophomore
Systems Analysis & Design	Analysis and design of technical, informational and organizational systems	Junior Core course
Data Structures	A Study of various types of data structures & their applications	Sophomore Core course
Database Systems	Theoretical and practical aspects of business database systems	Senior Core course
Visual Programming	Syntax, semantics and application of a visual programming language	Sophomore Core course
Data Communications	Intro. To LAN & WAN, communication protocols and security	Senior Core course
CIS Internship	One semester in industry or another institution with CIS	Senior Core course
Principle of Microeconomics	A study of the structure and performance of market economy	Junior Core course
Principles of Managerial Accounting	Financial statements for usefulness in decision making	Junior Core course
Intermediate Accounting I & II	A study of accounting principles for assets, liabilities, equity, revenues and expenses	Junior Core course
Business Communications	Practice of writing business letters and reports	Junior Core course
Applications of WWW in CIS	Development of web-based data base systems and application for technical information via the web and other interfaces	Elective Senior
Advanced Topics in Database	Theoretical and practical issues such as concurrency, distributed database systems and security	Elective Senior
Networking	Advanced topics in networking and Network structures and layers	Elective Senior
Quantitative Method I & II	Statistical methods with special reference to economics and business applications	Elective Senior
Principles of Finance	Financial concepts with emphasis on understanding how the principles of financial management can be used to enhance the value of a firm	Elective Junior
Principles of Marketing	A functional study of market organization designed to introduce basic theories in the field of marketing	Elective Junior

CONCLUSIONS

The curriculum we have developed has a solid foundation both in Computer Science and Business Administration and is designed to meet industry needs for CIS graduates. It is based on the industry needs survey conducted in May 1997. The program incorporates use of CASE tools and a visual programming course which will enable students to create Graphical User Interfaces for enhancing data visualization and performances. The application of resources from the WWW in a CIS program is a new and interesting feature of the program that makes use of rapid changes in the field that cannot be equaled using traditional textbooks. Finally, the internship is designed to make a link with industry and to assist students in learning more about the application aspect of their knowledge as well as helping them to explore the possibility of future jobs. This collaboration with industry will also provide opportunities for program assessment. Through continuous feedback we will be able to modify and reshape the curriculum to meet the needs of students and industry in the information age.

ACKNOWLEDGEMENT

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ENDNOTE

1. Unix is a Trademark of Bell Lab.

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A SYSTEMIC APPROACH IN DESIGNING COMMON SERVICE MODULES IN THE SUBJECT COMPUTING (IT/IS)

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The Hong Kong Polytechnic University's strategic plan for 2001 stipulated that a credit-based system should be adopted for all of its programs. One of the issues that needs to be addressed in the conversion of existing programs to a credit-based system is the maximum use of common subjects. The author undertook a funded project in 1996 which was to investigate the viability of having common service modules in Computing (IT/IS). This paper reports on a systemic approach in the design of common service modules in the subject Computing. The Department of Computing provides service teaching in Computing to all departments in this university and it is necessary to standardize the teaching of Computing. The current service teaching of IT/IS has been reviewed. The subject requirements of both the Course Leaders in this institution and the managers of local companies have been gathered through a questionnaire. It has been found that the Course Leaders in this institution and the managers of some local organizations have quite similar requirements of education and training but there are some differences. These findings are presented. Overall, the findings provide some valuable inputs for the design of 4 common service modules for the year-1 and/or year-2 sub-degree and degree students in this institution.

INTRODUCTION

This paper reports on a systemic approach in the design of common service modules in Computing (IT/IS). It is to address one of the issues that the conversion of existing programs to a credit-based system is the maximum use of common subjects.

The Hong Kong Polytechnic University's Strategic Plan for 2001 stipulated that a credit-based system should be adopted for all its academic programs. There is a need to investigate the viability of having some common service teaching modules for the subject Computing(IT/IS). Thus the university can increase the access to its academic programs, permitting a large number of students, not just those who can study full-time, but including those who will take specific subjects as part of continuing professional education.

Common service modules in (IT/IS) should be designed to cater to the needs of all students in this university. In the existing servicing subject modules in (IT/IS), it is common to find that students are taught software packages and programming languages in different subjects which have quite similar contents. Knowing their needs and establishing common modules in these areas may alleviate the problem of having different software. Much efforts can be saved in subject materials development. Also, the software packages and programming languages can be better managed and controlled.

SPECIFIC OBJECTIVES

This paper aims to :

a) Present the findings of current service teaching of the subject Computing (IT/IS).

b) Present the views of Course Leaders and local managers on their requirements in the subject Computing (IT/IS).

c) Propose viable common service modules in IT/IS to cater to the needs of many students who are non-computing majors.

METHODOLOGY

Review Current Teaching of (IT/IS)

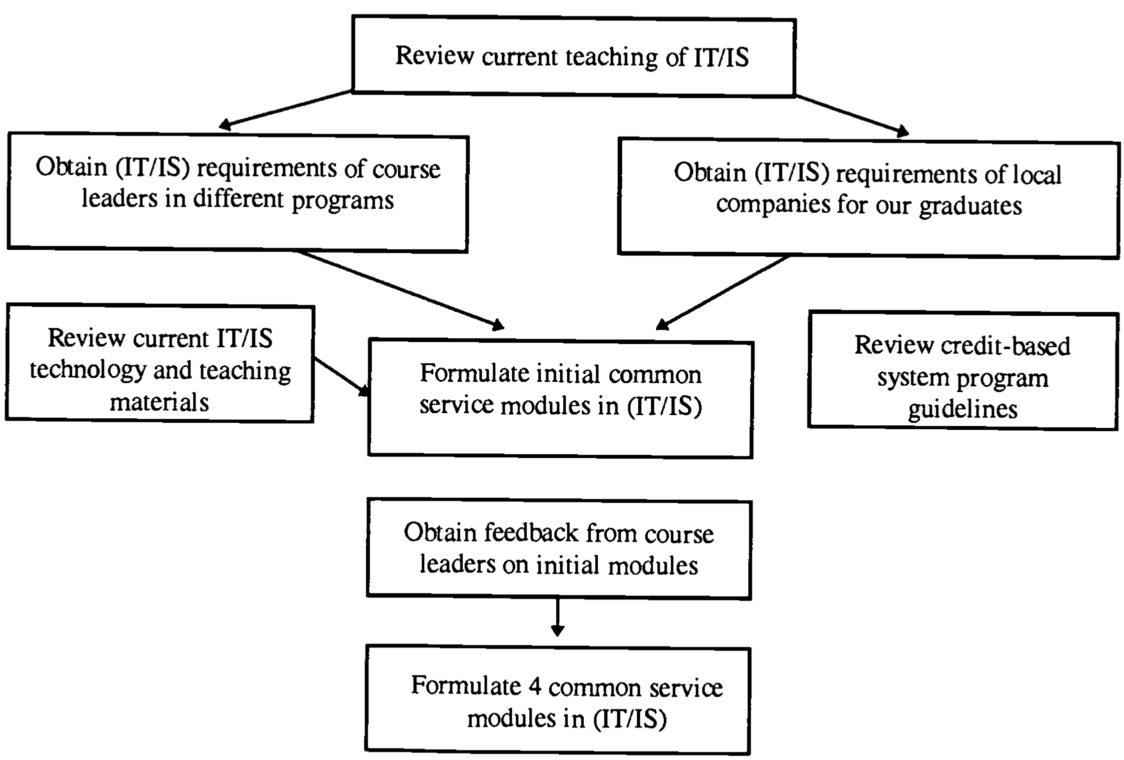
The teaching plans of all of the (48) servicing subjects ranging from High Diploma to Post-graduate levels have been reviewed and they have been decomposed into topics areas. This will provide a good understanding of how the subject of Computing (IT/IS) is currently taught in different programs. Information can be obtained on the popularity of common topics, the allocation of hours(lecture, tutorial, laboratory etc.) in various topics and also the methods by which the students are to be assessed. Furthermore, this will also give information on the average hours spent on each topic area which provides a guideline for subsequent module design.

Obtain (IT/IS) Requirements of Course Leaders in Different Programs

A questionnaire was created after the current teaching pattern had been reviewed. The questionnaire was sent to all Course Leaders in the servicing departments to determine requirements for IT/IS knowledge that their students should acquire. It was expected that many different programs may have new requirements to meet the changing needs in the professions. The requirements of (IT/IS) in different programs were reviewed for commonalties.

Obtain (IT/IS) Requirements of Local Companies for Our Graduates

This step is considered to be important as our education and training for students should meet the requirements of the local industry. The questionnaire which was sent to Course Leaders, was modified slightly and sent to managers of the local companies who had given recruitment talks to students from different disciplines. This method of information collection is to ensure that the (IT/IS) knowledge given to students will be



relevant to the local industry. It is to the benefit of our students that they will be able to make immediate contributions without much retraining.

The methodology used in designing the common service modules is as below:

Review Current (IT/IS) Materials

Having obtained some ideas on the possible topic areas for adoption, 6 publishers have been consulted on the availability of textbooks in (IT/IS). The trend in (IT/IS) is to be identified through publications in journals, magazines, articles in newspapers, seminars, video CD-ROM and video tutorials. This is to determine if up-to-date teaching materials are available to support teaching.

Review Credit-Based System Program Guidelines

In adopting the credit-based system, a common framework for academic program design should be used. There are some general guidelines established by this university for a Credit-based system. Subject module design will adhere to the standard guidelines.

Formulate Initial Common Service Modules in (IT/IS)

Initial common modules in IT/IS were established taking the following into consideration:

a. The current teaching pattern.
b. The requirements of Course Leaders in different programs.
c. The requirements of local companies.
d. The current trend in IT/IS.
e. The availability of teaching materials.
f. The credit-based system academic program design policy.

Obtain Feedback from Course Leaders on Proposed Modules

The proposed modules have been sent to Course Leaders for their comments and further suggestions. Their feedback would be used for subsequent module formulation.

Formulation of Common Service Modules in (IT/IS)

The input from Course Leaders provide valuable information for the revision of the proposed modules and creation of additional modules. The final version of the modules were produced with careful consideration of the suggestions and comments given.

FINDINGS

Current Teaching Pattern

The current teaching patterns could be obtained by decomposing the teaching plans into topics. As some of the teaching plans are not in standard format, it is required that experience and judgment be used in determining how the topics are grouped.

Among the computing subjects in different programs, it has been found that some topics are popular and they are :

- Hardware
- Software
- Database system
- Data Communication and Networking
- Information systems theory and management
- Programming concepts and algorithm design
- Software packages such as wording processing, spreadsheet and database
- Pascal programming

Each academic year has 2 semesters each of which lasts for 14 weeks. About 50% of the servicing subjects follow a two semester sequence. 53% of the subjects include a test as part of the subject assessment. 76% of them have assignments for students. On average, the proportion of lecture, tutorial and laboratory hours are in the ratio of 43:23:34. Also, the average weighting of coursework and final examination is 43% and 57% respectively.

There are also other pieces of useful information which can serve as guidelines for subsequent module design and they are as follows:

a. 11 Subjects are introduced in semester 1 and 10 subjects are introduced in semester 2. Twenty eight subjects require 1 academic year.

b. The proportion of hours given to lecture, tutorial for a subject without laboratory is in the ratio of 64 : 36.

Requirements of Course Leaders

Course Leaders and managers of local companies have been sent a questionnaire. It has two parts: General subject module information and subject module content (Lecture, Software packages, Programming). The 2-page questionnaire was so designed that it is easy to complete. This design will also ensure good responses. The questionnaires were sent out via the internal mail system and many of the Course Leaders have been very cooperative in completing and returning them. Some have given additional suggestions for my consideration.

The response rate was 85% and this represented a majority of the views on the requirement of (IT/IS) on the Common modules. A spreadsheet was created with all of the requirements for Course Leaders. This can facilitate 'What if' analysis in the module design. For example, What will be the largest number of students if the subject module is of 1,2 or 3 semesters duration and/or has 2 lecture hours per week. Information of this kind will be useful in designing the subject modules which will suit a majority of students. A summary requirement of the Course Leaders on general subject module information are as follows:

a. Duration for the common module

Duration for the module	1 Semester	2 Semesters	3 Semesters
No. of Courses	9	21	5

Most Course Leaders prefer the subject module to be 2 semesters.

b. Number of courses indicating the required number of Lecture, Tutorial and Laboratory hours per week

No. of Hours per week	0	1	2	3	4	>4
Lecture	1	15	15	1	0	3
Tutorial	16	13	3	1	0	2
Laboratory	4	12	14	1	2	2

This indicates that for most courses, the preference is to have 1 to 2 hours of lectures, 0 to 1 hours of tutorial and 1 to 2 hours laboratory per week.

c. Nature of the subject module(Core/ Elective)

Nature of the subject module	Core	Elective
No. of courses	35	0

The (IT/IS) module(s) are considered to be core required subject.

d. Level of study(sub-degree/Degree/Post-graduate)

Level of Study	Sub-degree	Degree	Postgraduate
No. of courses	11	24	0

The (IT/IS) module(s) are for sub-degree and degree courses.

e. Year of study

Year of study	Year-1	Year-2	Year-3
No. of courses	18	15	2
No. of students	405	1655	200

The subject module(s) can be introduced in year-1 or year-2.

f. Mode of study(full/others)

Mode of study	Full-time	Others
No. of courses	34	1

On the contents of the subject module, each Course Leader is requested to give an assessment on the importance of each topic on a scale of 1 to 5 (1 is the least important and 5 is extremely important). The average score of each topic was then computed and represents the overall view of the importance of each topic. The average scores were then ranked in descending order of significance and this shows the relative importance of each topic. The popularity of the topics have been found to be as follows:

Lecture Contents	Average score
Computer Applications	3.92
Computer Software	3.79
Database Systems	3.33
Management Information Systems	3.21
End User Computing & IT Management	3.17
Software packages	**Average score**
DOS / Windows	4.17
Word Processing	4.00
Integrated Software Packages	3.92
Spreadsheet	3.67
Database	3.38
Programming Languages	**Average score**
C++	2.08
Pascal	2.08
FORTRAN	1.96
C	1.88
QBasic	1.75

The above findings represent the responses of the Course Leaders. Some Course Leaders expressed many different requirements. e.g. Macintosh operating system as well as Windows, Business simulation, Statistical package, Software packages (wording processing, database), Chinese Computing, Object Oriented concept, Artificial intelligent, Expert systems, Photo Image Manipulation etc. Some of their requirements may not be easily incorporated in the common modules.

Requirements of Local Companies

The same questionnaire was also sent to managers of the Hong Kong companies who gave recruitment talks to our students. The requirements of the managers were sought as our curriculum should be appropriate to the needs of the local companies. A spreadsheet was created with all of the requirements gathered. A total of 12 responses have been received. A few managers have been interviewed and also the Hong Kong Institute of Engineers, a professional body has also been interviewed. Some of the managers expressed the need for the followings :

- SQL
- Software Development process
- Quality business impact with IT/IS
- Accounting related software
- Assignment that requires team formation for practice
- Computer applications
- Project Management
- More concentration on MIS

Since the requirements of the Course Leaders and that of the local industry have been gathered, it would be useful to investigate if there is any similarity or difference in requirements between these two parties. The result of the analysis can strongly support the design of the subject modules. It has been found that the similarity of requirements of important topics are as follows :

Popular topics perceived tobe important by Course Leaders and Managers	Average score of Course Leaders	Average score of Managers	Mann-Whitney Test Z value, (Asymp.Sig.)
Lecture Contents			
Computer Applications	3.92	4.08	-0.767 (0.443)
Computer Software	3.79	4.08	-1.298 (0.194)
Database Systems	3.33	3.83	-1.661 (0.097)
Mgmt. Information Systems	3.21	3.83	-2.411 (0.016) *
End User Computing & IT Management	3.17	3.58	-1.663 (0.096)
Data Communication & Networking	3.04	3.92	-2.700 (0.007) *
Privacy, Security & Ethics	2.88	3.58	-2.296 (0.022) *
Systems Analysis and Design	1.92	3.50	-3.581 (0.000) *
Software Packages			
DOS / Windows	4.17	3.83	-0.269 (0.788)
Word Processing	4.00	3.92	-0.205 (0.838)
Integrated Software Packages	3.92	4.25	-1.570 (0.116)
Spreadsheet	3.67	4.00	-1.285 (0.199)
Database	3.38	4.00	-2.112 (0.035)
Internet	3.38	3.33	-0.756 (0.450)
Project Management	2.42	4.08	-4.329 (0.000) *
Programming & Languages			
C++	2.08	3.58	-2.989 (0.003) *
Visual Basic	1.75	3.50	-3.909 (0.000) *
Fourth Generation Languages	1.81	3.25	-3.230 (0.001) *
C	2.00	2.92	-2.346 (0.019) *

Average score of Course Leaders and Managers are provided for each of the lecture topics. Mann-Whitney Test was used to test the mean differences of statistical significance at 0.05 level. Those marked with an '*' indicate that the mean differences are significant. The analysis of findings provide some interesting results. Management information systems, Data communication & networking, Privacy, Security & Ethics, Systems analysis & Design and Project Management have been conceived to be important in the local industry but they are not considered to be that important in the PolyU environment. C++, Visual Basic, 4th Generation Languages and C are considered to be the most popular programming languages in the local companies. In general, Programming Languages are considered to be less important compared with theoretical lecture content and software application packages.

Availability of Current (IT/IS) Text Books

It has been found that a large volume of textbooks published in recent years are available to support teaching. There are also plenty of materials available in other sources such as video CD-ROM, journals etc.

Policy on the Design of Credit-Based System

The policy on the design of a credit-based system needs to be followed and to impose a design constraint. Each academic year has 2 semesters each of which has 14 weeks. Academic programs should be so designed that they are built-up of subjects of standard sizes and consist of subjects which have values expressed in terms of credits. In terms of student effort, a student is expected to do 35 to 45 hours of study (inclusive of contact hours, private study etc.) to earn a credit. However a credit is to be translated into contact hours. Hours of supervised work and private study will depend on the teaching/learning activities and the nature of the subject matter.

The standard credit value of a subject is 3. It is suggested that a student will normally take 18 credits (for undergraduate courses) which are equivalent to 6 subjects of 24 credits in a semester.

Formulate Initial Common Service Modules

Two common service modules each of which offers 3 credits, have been formulated. One module is purely theoretical and the other is for hands-on application skills. The topics to be included in the modules are those which have been perceived to be important by Course leaders and managers. The 2 modules did not have programming component as programming languages were not considered highly by either Course Leaders or managers in Hong Kong. Also, the inclusion of programming languages may not give these modules cohesion.

Feedback from Course Leaders

The 2 formulated modules were sent to Course Leaders for review and comments. About 50 % supported them and the general comments were as follows : a). Programming should be taught. b) The students can take only 1 subject module and the module should have both theoretical and practical components. c). The modules should be 2 credits instead of 3.

FORMULATION OF COMMON MODULES

Having reviewed the suggestions and comments of the Course Leaders, 4 common service modules have been formulated. A brief summary of them are :

Introduction to Information Technology

This module is a purely theoretical subject in IT/IS. Topics include computers, Data communication & Networking, Database systems, Management Information systems and End-user Computing.

Applied Information Technology

This module is a practical one in the use of information technology applications. Students will work with some popular packages. They will be given an opportunity to study and communicate through the use of IT. In addition, students can choose an application package to suit their own needs.

Computer Programming

This module is designed to introduce students to the concepts of structured programming in a popular third-generation language e.g. C.

Fundamentals of Computing

This module has both theoretical and practical components. Students are provided with the fundamental knowledge of computing and have the opportunity to develop the necessary practical application skills.

CONCLUSION

This paper has described a systemic approach to designing common service modules in IT/IS. The current service teaching of IT/IS have been reviewed. The requirements of both the Course Leaders in this institution and the managers of the local companies have been solicited. Initial modules had been formulated for review and comments by Course Leaders and their comments have been taken into consideration for further enhancement of subject module design.

It has been found that the Course Leaders of this institution and managers of some local organizations have quite similar requirements for the education and training given to our students. Common service modules can be designed tailored to requirements for the year-1 or year-2 sub-degree and degree students in many different programs. It is hoped that they will be adopted for the future credit-based system in this institution.

Finally, It is also hoped that my experience in designing common subject modules can be shared among academics in Computing.

ACKNOWLEDGMENTS

The Learning and Teaching Development Committee of the Hong Kong Polytechnic university provided the funding for this project. I wish to express my appreciation to all of the Course Leaders and managers of local companies who have been involved with this project for their help and cooperation in providing valuable information.

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SAVING THE IS SOUL IN AN INTEGRATED MBA CURRICULUM

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EXTENDED ABSTRACT

Since Spring quarter 1993, all content of our University's core MBA courses has been delivered in a completely integrated format. Lacking a core information systems course, we endeavor to deliver "what every MBA student should know about IS" within the context of eight, integrated core courses. Example courses include one or more quarters of High Performance Management (HPM), Foundations of Business Decisions (FBD), Positioning in the Competitive Environment (PCE), Values, and Quality. In a prior paper (source omitted for anonymity) we describe the integrated curricula in HPM, PCE, and Quality from an IS point of view.

Two paradoxical phenomena have occurred in the four-year interim since the curriculum became integrated. First, the number of students entering our MBA-IS specialization has more than doubled, and second, the IS content in the integrated core as been ratcheted down to where it exists in only one course, PCE. Whereas the strategic impacts of IT are covered well in PCE, other IS topics are unheeded.

In this paper we revisit the integrated curricula in order to understand what happened to the IS content of the core curricula. Our purpose is to share derived insights to benefit colleagues whose institutions have, or are planning to implement, integrated MBA curriculum. Some of our insights were gleaned from student focus groups and others derived from internal, departmental discussion. An additional source is the arguments based on the "Information Technology Interaction Model" provided by Silver, Markus and Beath (1995)[1] and stressing the concept of "fit" between an organization's information systems and its business, culture, and environment.

Our discussion embraces three categories: lack of resources, student requests, and curriculum relevancy. The lack of resources is straightforward. Our department is small and it has become infeasible to staff multiple sections of every integrated course. Thus, in High Performance Management (HPM) there may be IS faculty in one section, but not in two others. In this particular course, curriculum varies according to faculty member expertise and interest.

Student requests are in the area of advanced IT productivity skills (e.g. spreadsheets, databases, project management, Internet). Students generally work in teams and a common observation from both faculty and students is that the student-team member already possessing technical skill in spreadsheets, for example, will complete the team's spreadsheet. Students admit that they do not take advantage of optional opportunities to improve their IT skills through workshops and self-instruction – they are just too busy with course obligations. They are requesting course credit to prompt their concentration on skill development.

The issue of curriculum relevancy may be the most important. Initially, we took a topic approach toward deciding what subjects should be integrated. Topics were gleaned by examining IS textbooks. Illustrative topics comprise databases, the systems development life cycle, IT for strategic advantage, and networking. The problem with the topic approach is that it may reduce opportunities for teaching information systems from a systems perspective.

For example, in the Quality course the faculty wrote an integrated case describing actual events

in a hospital scenario. The hospital suffered severe problems with their aged-accounts receivables and mistakes in billing, conflicts between medical and administrative staff, incorrect prescriptions, and multiple, non-integrated departmental information systems. The intent of the Quality course is to have students use Quality tools to determine root causes, priorities for action, and recommendations for action implementation. Invariably, one recommendation was to integrate the disparate information systems. While there was time allotted to teach steps for developing an information system (a topic), there was little time for consideration of the organizational context and the interaction between that context and the information systems (a systems perspective).

Fortunately for us, we have the backing of the faculty and the Dean to improve the IS content of our core MBA. However, it is difficult to retrofit the curriculum once established. We will offer a series of eight, one-credit hour, productivity courses designed to build on basic knowledge to form a level field of IT skill while working on student teams and competitive competence in the job market. In addition, we will tailor assignments to complement IT assignments given in the core courses. We will institute an elective course on information systems which will allow us an opportunity to teach IS organizational fit concepts as well as features of an information system.

The paper considers three recommendations for those planning integrated curriculums:

- Reflect on the Information Technology Interaction Model (Silver et al. 1995) as a game plan for designing integrated curriculum.
- Procure cases (or develop them) which stress environmental, organizational, and cultural issues in IS as well as specific IS topics.
- Pay attention to potential student demand for advanced IT skills. Provide credit for IT skill training while improving student competency for IT assignments given in the core curriculum.

ENDNOTE

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THE MIS CORE COURSE: A REVOLUTIONARY LOOK

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This paper discusses the remaking of the MIS core course in a graduate business degree program. The graduate MIS course has many of the same problems as the undergraduate one, which has been identified in several articles as "the widow maker." Several attempts to modify the course actually resulted in lower evaluations. The course then underwent a major redesign. The new course does not "teach technology", rather students learn about how basic business functions and operations can be impacted in both good and bad ways through the use of technology. Technical issues are brought up only to the level that the discussion of functional organizational issues requires technical knowledge for understanding about what is happening and why. Initial results indicate significant improvement in student understanding of important concepts, perceiving the need for management involvement, and recognizing the importance of the course. Finally, the revised course resulted in higher satisfaction with the entire course for both students and instructors.

INTRODUCTION

The undergraduate MIS core course has been identified by both students and faculty as being generally unsatisfying and often providing students with little practical information. A similar course has been included in the business core of most MBA programs (AACSB, 1991). The course is called a variety of names including Management Information Systems (MIS), Information Systems (IS), Information Systems Management (ISM), or Information Technology (IT), all of which were identified as course names in a review of various schools' graduate business programs. Although there have been numerous articles discussing the course and various approaches to "fix" it, the course remains a problem at many schools.

BACKGROUND

Albin and Otto (1987), Buckingham et al (1987), Cheney et al (1990), and Padget and Meyers (1995) all present varying views of the needs of organizations and ways to use and integrate technology into the curriculum. Richards and Kelly (1994) discussed what they thought were the most valuable components of IS education. Woods (1992) discussed the importance of technology issues and education in the MBA. A consistent theme noted in all of these articles is that graduates of MBA programs generally lack understanding of the technology used in business today, and its impact on the organization. This has lead to a general conclusion that technology must be made a more integral part of the MBA program in particular and business programs in general.

Although not the best solution to the problem, the typical response has been to produce a course that takes one of three forms. One approach is an introductory course on various computer applications, word processing, spreadsheet, data base, and presentations. This course, while reasonably well accepted by undergraduate students, is not a course for working adult students, who generally have some knowledge of these programs. It is not a graduate level course, and it certainly has little to do with the information function in an organization. The second approach is the survey of MIS. This approach is exemplified in courses which use texts by Louden, Shulthies, McLeod, etc. One section contains chapters on the systems approach, computer hardware, system and application software, and databases. Another section which describes the operation of the IS systems in the various functional areas, Accounting IS, Finance IS, Marketing IS, Human Resource IS, follows. Finally, there is a section on networked systems, office automation, and trends for the future. The last approach tries to combine both of the previous approaches into one course similar to the MacMillan computer system year books at the undergraduate level.

This course has a goal or desired outcome to provide knowledge of Information Systems to students, who for many this will be their only "technology" course. The problem is that in many cases the knowledge is either not articulated clearly or is lost in a sea of facts, which are memorized for an exam and then forgotten. Student response to the course at the graduate level closely mirrors the dissatisfaction noted at the undergraduate level.

Twenty schools were surveyed about student views on IS and the IS course (Novitzki, 1990). Results showed that an overwhelming number of students, 87.3 percent, felt that the IS technology course that they received was not a meaningful course. Material was not relevant to them and focused on issues that were not of interest to them. Interestingly, there was no significant statistical difference between responses from various schools even though several different approaches were used in the courses.

FIRST REVISION

The technology course at our school was no exception to the points described above. The business core in our MSB program is virtually identical to the core found in most MBA programs. For several years our IS technology course, which is called Information System Management (ISM), has used one of the standard MIS texts, presenting history, hardware, software, various information systems, expert systems, etc. in a general survey of Information Systems.

Our students have on the average been out of school for 10 years, are working full time, and most do not have either technical or business undergraduate degrees. Their comments on the course are consistent with that reported in earlier studies focusing on the course's lack of relevance, requirement for mindless memorization of facts, little tie to the rest of core, and no connection to the program as a whole.

The course went through a major revision based on student and faculty responses, almost all of which resulted in additions to the course. More group work was added, more hands on computer exercises were added, etc. Students were required to use Power Point, send E-mail, do Internet searches, etc., besides covering the general survey of IS.

Previous end of course evaluations revealed little consistent difference in student attitudes towards IS although there was often a slight numerical increase. This revision, showed a significant increase in the use of and familiarity with technology and various software applications. A major concern was that in some class sections, the students' view of the need for technology knowledge actually showed a significant decrease in value. Before the course's revision, on a five point Likert scale the average score for the value of the course was 3.7. After the revision with its many additions, the average score was 3.52. With an n=97, the difference was significant at .05 level. Student opinions about the value of technology are also taken in the surveys at the beginning and end of the course, and these were also compared. Previously, the comparison revealed little change, but there was typically a slight numerical increase. The revised course comparison revealed, that in this case, the numbers were lower. After the course, there was an indication that students actually felt less need for knowledge about technology and its uses to do help their jobs than before they took the course. The results indicated that our students could be better prepared for the technical work place if we eliminated the course as currently taught!

Specific issues mentioned in course evaluations were: students with a technical background reported that the group discussions on IS issues were really an important part of the course. They were frustrated by the lack of IS knowledge demonstrated by most students in the course, and they felt that the computer application exercises were a waste of time. Students with no significant technical background felt that the hands on exercises with the application packages were the best part of the course, and the hardware, software, and systems discussions were a waste of time. Student comments also focused on the inordinate amount of work required for the course, and the fact that most material did not seem to impact them in the jobs. This last point was a key point leading to the new course development. IT did not seem relevant to them or their jobs, even though it impacts jobs at all levels in almost every organization. Since over two thirds of students taking the course could see no relevance, it was obvious that we were doing something wrong.

PRESENT REDESIGN

As noted above, several problems had been identified both in other studies and by our students. The key points were: First, the course held no relevance to business students. Many students felt it was like a general education requirement giving some background, but which wasn't really important for most managers. Second, some students felt that the course should provide basic skills in using specific technology and software rather than discuss general uses and purposes. Most students agreed that the course, as formulated, was trying to do too much. New requirements had been added to the course, but nothing was deleted. Several comments were particularly revealing. Less than 25% of the students felt that they had learned anything. Second, for almost 60% of the students, the IS discussion cases served no purpose because they did not have the back ground to address the problems or in some cases even see that there was a problem.

COURSE CHANGES

One of the key elements of concern in any revision of an academic program should be the needs noted by business and organizations who employ the program graduates. A review of literature identified several articles that presented ideas that should be addressed. Chow and Edmundson (1994) discussed what IS employees lack from the employers standpoint. Alavi et al (1995) and Godfrey (1995) addressed issues for consideration and some of their ideas were included in this revision. It was clear that merely adding things to the course was not a solution. A major change in direction and philosophy would be necessary to provide a solution. The hands-on computer exercises were clearly not helping students either in their understanding of IS or their use, although they did provide skills with various office applications. A review of the ACM and DPMA model curricula and interviews with IS professionals and business executives pointed to three general outcomes that the course must give students. First, students must understand that IS plays an important role in every organization. Second, functional managers throughout the company must have a basic understanding of what IS can do for a company or to a company, if it is not managed properly. Third, having established these concepts, then the course should define the role of functional managers in dealing with IS.

From these concepts and ideas several key determinations were made about the new course:

1. The graduate IS course should NOT be used to address computer skill training.
   a. Students with a familiarity with standard application software, such a Word, Excel, Access, Powerpoint, etc., but a need to improve skills, can attend free short workshops.
   b. Students with no expertise or skills can attend short one and two day non-credit courses which are offered several times during the term.
2. The survey approach of covering everything there is to know about IS would not be used.
   a. Business students generally do not need knowledge about a wide variety of specific hardware and software because they change so frequently.
   b. Business students need detailed focused information about their role in the management and development of IS programs.
3. IS would not be discussed outside of an overall organizational context.
   a. Everything should be tied to how a organization operates.
   b. Any technical information is presented as part of what or how something is being done.

Based on the decisions discussed above, in the spring of 1997 a syllabus was developed that focused on these outcomes and which identified enabling objectives and methods that would help students achieve the desired outcomes. The result is a course that looks little like a "technology course." It rather looks like a capstone course, in that it largely focuses on cases and articles about business issues in current organizations. The difference is that this course builds on general business knowledge, and the role of the functional line manager. It then links these together with the capabilities and limitations of Information Systems and their ability to address these issues.

SPECIFIC COURSE CONTENT

The only assumption made was that students have no real knowledge of the impact of information technology on organizations. Course specifics include:

1. Present a brief history of data processing and Information Systems in organizations. Discussion focuses on how the role, impact, and capability of IS systems have changed. It then highlights the need for line managers to become more involved in technology decisions as computer systems become more pervasive in the organization. There is no focus on changing technology except in passing to explain new or increased capabilities. The purpose is to point out the change of IS from being a back office operation to involvement in key operations in organizations.
2. Highlight technology with Information System success stories. This part of the course highlights what IS has done to create new markets, give new capabilities, speed up operations, improve decision making and product quality. Use before and after success stories showing how IS was able to allow a company to do something different, better, faster, or cheaper than it could without IS.
3. Discuss elements of Information Systems at an introductory level. When discussing organizations, the instructor identifies the various elements of IS and discusses them at the level necessary. For example, a company uses a data warehouse to improve inventory control. The Instructor then explains what a data warehouse, database, fields, records, indexes, etc. are, but all tied to a manager's standpoint not the technical focus. A careful selection of cases or articles allows the instructor to cover most of the technical elements of an information system.
4. Present failures of Information Systems. Present some stories, articles, cases, etc. where IS implementation was abandoned, didn't work, or was a disaster. Again bring in technical elements as needed, but focus on what caused the project to go wrong.
5. Discuss the role of functional managers with Information Systems. For many of these failures, a lack of early functional management involvement is a continuing thread, and the instructor should highlight the consequences of such inaction.
6. Identify the need for functional managers to be involved in the management of information systems. The point to stress is that just because a manager does not understand all the nuances involved in IS does not mean that they should abdicate their role as a manager to others when considering IS programs, projects, and time lines. Use technically knowledgeable students to help make points.
7. Describe System Life Cycle and the manager's role in the development process. Having laid the ground work previously, discuss how systems are built and the system life cycle, but emphasize the role functional managers must play throughout the process. The presentation goes through a standard description of the elements involved, but focuses on the role managers should play. A key point to be highlighted is the mistakes managers, who don't understand IS, make, especially in the implementation phase. Such things as unrealistic schedules, saving money by reducing training costs, or saving time by reducing testing are typical errors that have had major repercussions in the development and use of Information Systems.
8. Have student's research their company's Information System. Students describe how computer/information systems are used in their company/industry. This often shows there is a close link between the integration and use of technology and their company's competitive position in the market place.
9. Have students do a group case analysis. At end of course, divide students into groups to analyze a case to explain what the IT

elements were, which went right or wrong, and what functional managers did or did not do to ensure the success of the project. Several videos from the IRWIN Information series are used to support discussion and to get students involved.

RESULTS

The redesigned course was first offered in one section during the summer term of 1997. Two sections are being run during the fall semester. There are 18 student surveys and end of course comment sheets from the summer term. At the end of the fall semester there will be an additional 51 student comment sheets from the 2 additional sections of the redesigned class.

Evaluation Procedure

Selection of the class section to use for the revised course was completely random and students did not know that their course was going to be different until after classes started. A survey is presented to students the first day of class. This same survey was given to all classes in the summer term and fall semester. The questions covered the students' background, technical expertise, familiarity with applications, feeling on importance of technology in business, and their feelings on the need for the course. The same survey is given at the end of the course along with a standard student course evaluation which included questions about course ranking, usefulness of course, and amount learned in the course.

Analysis: Beginning of course survey results for the summer course were compared to the previous classes. A t-test for difference of means was performed on all responses. The highest t noted was 1.46 which was well below the critical t of 2.021 for a two tailed test and a level of significance of .05. All of the other t scores were numerically less which indicates that there were no significant differences in the students responses between the class sections. See Table 1. These surveys from the beginning of the course continue to show that, in general, business students generally have a low understanding of the impact or use of technology across all areas in business.

TABLE 1

BEGININNG SURVEY COMPARISON OF PREVIOUS CLASS TO PRESENT CLASS

Key Items	Observed t
Need for Course	0.94
Knowledge of IS	1.46
Importance of Course	0.67
Need for Management Involvement	1.22
Need for Management Knowledge	1.04
Value of IS	1.14

The results of the end of class survey and end of class questionnaires for the revised course were compared in two ways. First, the revised class beginning and end of class surveys were compared to see if there was any significant difference between the student responses at the beginning and at the end of the course. The t-test for difference of means was again performed on all responses. All responses indicated improved values, and four had differences that were statistically significant. Student knowledge of IS, interest in its uses, importance of the course, and need for management knowledge of IS, all had t scores of 2.12 or higher. The t of 2.12 was above the critical t of 2.021 for a two tailed test and a level of significance of .05. See Table 2. This indicated that several significant changes had occurred as a result of the class.

Finally, the end of class evaluation and survey were compared between the original class and revised class. In this case the same four categories resulted in high t scores, but all six were statistically significant. The lowest t score of the six was 2.29 which was significant at the point .05 level and one, need for management involvement, had an observed t of 2.46 which was significant at the .02 level which indicated a very significant difference. See Table 3. These results are extremely encouraging. There were numerical improvements in all other categories as well.

TABLE 2

PRESENT COURSE
COMPARISON OF BEGINNING AND
END OF CLASS SURVEYS

Key Items	Observed t
Need for Course	2.19
Knowledge of IS	2.06
Importance of Course	2.12
Need for Management Involvement	2.17
Need for Management Knowledge	2.02
Value of IS	2.29

TABLE 3

END OF CLASS SURVEYS
COMPARISON OF PREVIOUS CLASS
TO PRESENT CLASS

Key Items	Observed t
Need for Course	2.29
Knowledge of IS	2.46
Importance of Course	2.31
Need for Management Involvement	2.41
Need for Management Knowledge	2.34
Value of IS	2.38

At the end of the course, students felt an increased need to learn more about technology, its capabilities, and its limitations. Many also realized the major role that all functional managers must play in the development of new IS systems. Most also acknowledged that all managers must have some technology knowledge if they are to be effective managers in the twenty-first century. A key point was that these comments were in the free form comments section of the evaluation. There was no direct request for comments in these areas in either the survey or the evaluation. The results and comments are indications of students achieving many of the goals that have been articulated for this course. If these results are repeatable in the following terms, they indicate a pedagogy that deserves further exploration and experimentation.

After the summer, student comments were reviewed, and a few minor adjustments were made on the amount of time and level of coverage of some topics. All sections of the course will use the new course format in the spring semester.

These results are extremely preliminary, but they do point to a possible improvement in a course which has been a problem in the curriculum for years. There are, however, several possible mitigating factors such as impact of the professor, the unique way the course was offered with no text and complete dependence on handouts and cases, the fact that this course section was different than the others. These combined with the extremely small sample size mean that little can be generalized at this point.

At the end of the fall semester, results should be more generalizable, and at the end of the spring term all of the issues will have been addressed. Only two instructors have been involved in the course up to now. Three more will be involved by the end of the fall, and in the spring all instructors will be using the revised format. Even if a text has not been found, the handouts and cases will have been standardized to the point that they will be sold through the bookstore. All sections of the course, a total of eight sections, will be taught as the revised course. Of these sections, two will be in a shortened six week format instead of the usual 15 week format to see if the course format might have some effect on student responses.

CONCLUSIONS

The addition of a technology course as a simple add on has generally not been effective in achieving increased student awareness about major technological issues in business. The revised course, as described here, appears to produce the outcomes desired without requiring the major overhaul of an entire program. Initial responses from students indicate that the new MIS course may finally do what it has been expected to do since its creation. It appears to make business students aware of the importance of IS in organizations, provide students with basic understanding of the elements of information systems, and make students aware of the critical role all managers play in the success of IS projects in an organization.

FUTURE ISSUES

Many issues need to be resolved. There is no text book that fits this course model. As a result, the course relies on extensive handouts. Cases that fit course requirements and examples have not been fully developed. Extensive research is required of both students and instructors to keep examples topical. As a result the course is instructor work intensive. If full implementation produces comparable favorable results, then effort must be done to develop suitable materials to reduce workload and make the course more consistent with other courses in the program. When this is completed, and if the results continue to show the favorable results, then other schools should experiment with the course to verify improved results in other settings with a larger base of students.

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PEDAGOGICAL DILEMMAS IN TEAM-TEACHING: AN INTERDISCIPLINARY I.S. AND MANAGEMENT MBA COURSE

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INTRODUCTION AND OBJECTIVES

A number of curricular reforms are in progress in undergraduate and graduate business education in the United States. In part, these reforms are in response to criticisms by both academics and industry practitioners of the traditional discipline-based structure of most programs that are thought to inhibit integrative problem solving and holistic thinking by students. While most programs are still in the process of change, early assessments of these reforms indicate painful change and mixed success (e.g., Boyatzis et al., 1995; Davis, 1995).

At our university, the redesigned MBA curriculum is in its second year of full implementation. For a number of reasons but primarily as an initial step in facilitating integrative learning by students, four interdisciplinary core courses each representing two business disciplines have been instituted to replace seven single-discipline based core courses. Further, each interdisciplinary core course is team-taught by faculty pairs representing the two disciplines. Consistent with the mixed success of other programs, early formal and informal indications are that some courses are successful while others are less so. Extant literature on interdisciplinary team teaching is sparse and further research is required to understand and explain this mixed success in order to provide guidance for successful reengineering of business programs.

Our research objective is to identify pertinent pedagogical issues that might influence the success of interdisciplinary team taught courses. While there are potentially a large number of issues that can affect the success of any course, we intend to focus on those particularly relevant to collaborative courses. This paper describes an initial set of pedagogical dilemmas derived from our experiences in developing and team teaching the MBA core course that combines the disciplines of information systems and management. The subsequent step in this research will be to assess the face validity of the dilemmas identified before utilizing these dilemmas in empirical studies of the more and less successful courses in our program.

PEDAGOGICAL DILEMMAS

The disciplines of information systems and management are similar in that both draw from multiple reference disciplines and both focus on supporting the organization across functions. However, there are important differences between these disciplines that constrain how they contribute to a single academic course. In comparison to information systems, management has an older, more theoretical, and more stable base of knowledge. Although information systems core courses traditionally have dealt with a variety of technical and organizational issues, students' perceptions and expectations are that information systems courses will be somewhat technical while management deals with "soft" skills. These perceptions and expectations often translate into the disciplines' utilizing quite different instructional methodologies. From our experiences in combining these different disciplines into a single course, we have identified five pertinent pedagogical dilemmas. Our observation of and discussions with colleagues team-teaching the other interdisciplinary core courses in our curriculum lead us to believe that these dilemmas are relevant to any cross-disciplinary team-taught courses.

Pedagogical Orientation: Learning vs. Teaching Paradigm

Adopting an underlying philosophy consistent with the learning paradigm (Barr & Tagg, 1995), instructional activities shift from teacher-centered instruction to student-centered learning. As a result, process issues focused on active learning become central concerns, while outcome concerns such as evaluation and grades take a back seat to student growth. Dilemmas are posed by choices and structural constraints related to content; however, it is critical to comprehend that a process focus does not imply a "content-free" course. To the contrary, content is still essential and critical, but it is driven more by student initiative and interest than by instructional plan. In this approach, faculty roles shift from "expert" to "learning facilitator"; student roles move from "knowledge absorber" to "self-directed learner"; and the classroom focus goes from "information transfer" to "learning community."

Classroom Dynamic: Constructivist vs. Didactic Approach

The constructivist approach begins with a simple notion: "we construct our own understandings of the world in which we live" (Brooks & Brooks, 1993, p.4). This view is essentially non-objective; it defines knowledge as temporary, socially and culturally mediated, where learning is a self-regulated process. Student thinking drives the learning process, where value is placed on dialogue, inquiry, puzzlement, and multiple perspectives - "truth" is a matter of interpretation. Since most MBA students bring a wealth of experience to the classroom, learning becomes a matter less of discovery than interpreting through a different schema. In this way, students have an opportunity to engage in sensemaking by synthesizing their experience in the context of prior understandings. This class format allows for student-directed discussion where "learning" is more emergent and evolving than "planned."

Underlying Strategy: Process vs. Content

While this notion is related to the ones noted above, this tension argues that content is secondary to process issues. Process concerns how action and interaction unfold over time, and how meaning and interpretations are constructed around these experiences (Pfeffer, 1982). Thus, course design and implementation explicitly revolve around problem identification and solution, utilizing different frames, and information processing. Without doubt, this approach entails adoption of a different epistemology (Schon, 1995) valuing alternative ways of thinking, reflection, fresh metaphors, and new conceptions of learning. In attempting to integrate disciplines, attention to process overrides (but does not obviate) content issues.

Faculty Role: Modeling vs. Instructor Enactment

One temptation associated with integrative courses is for faculty to undertake the integrative activities themselves. Students sometimes report that team-taught courses are "interesting" because the faculty members engaged in dialog or debate, thereby exemplifying the "value" of integration! The dilemma here is that, while faculty may provide examples of integration, a fine line emerges between providing a model of desired intellectual behavior and actually conveying their own preferred disciplinary connections. In a student-centered classroom, integration should occur as a result of student initiatives rather than from faculty interaction. Of course, if too much "modeling" occurs, the class regresses to a teacher-centered focus without providing students with sufficient opportunity to explore conceptual linkages among multiple disciplines.

Influence Processes: Shared vs. Dominant

Personality differences, natural tendencies or contextual consequences may exist that lead one team member to play a more active role in the classroom milieu. This is a particularly acute tension in mixed-gender pairings, i.e., female faculty members are often perceived as having less power than males on a teaching team (Davis, 1995). Faculty need to be cognizant of such issues to ensure that actual or perceived differences do not interfere with the student learning. Thus, the roles and actions (including nonverbal) of each team member during the conduct of class convey powerful symbolic messages. For example, the location of and signals sent by the secondary member during mini-lectures or case discussion can affect student perceptions. Other issues include team member disagreements, time in dominant role, and chemistry or compatibility concerns.

Thus, in considering the above tensions, our working hypotheses propose that team teaching is more likely to be successful for both faculty and students if the team members adopt the learning paradigm, develop a constructivist classroom, explicitly focus on process concerns, exercise modeling constructively, and be conscious of sharing classroom responsibilities. Indeed, the design of our course reflects these hypotheses. While our course has been successful from the perspectives of students, faculty, and administrators, it would be valuable to evaluate the hypotheses in case studies of the other core courses in the curriculum. Before collecting such empirical evidence, we would like to establish the face validity of the dilemmas and potentially add to the list of dilemmas through dialogue with other academics. While the current list is not intended to be exhaustive, the dilemmas identified do provide a framework for discussion and curricular reform.

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INTEGRATING TEAMWORK INTO INFORMATION SYSTEMS COURSES

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Teams are becoming increasingly important as an organizational form, particularly in information systems development. In response to this trend, a number of educators, including IS educators, include team components as part of their course curriculum. For example, many systems analysis and design courses include a team project component. It may not be enough, however, to simply have a team project. It may be necessary to integrate instruction in teamwork skills into IS courses.

This paper discusses the importance of teams and delinates the knowledge, skills and abilities (KSA's) necessary for effective teamwork. In addition, the paper provides an example of how instruction in these KSA's can be integrated into IS courses. Finally, the paper presents the early findings of a research program which examines the effectiveness of the proposed aproach.

INTRODUCTION

The organizational form of teams is becoming increasingly important to organizations (Fulk and DeSanctis, 1995). As a result, employers desire employees who are skilled in teamwork. The information systems (IS) field is not immune from this emphasis on teams and teamwork. The team is a popular organizational form for IS development (Abdel-Hamid & Madnick, 1991, Ford & McLaughlin, 1992, Phan, et al., 1995). Due to this interest in teams, IS educators need to teach their students how to effectively work in teams.

This paper has three purposes. One, it discusses the importance of teams and teamwork both to organizations in general and to IS in particular and also delineates the knowledge, skills and abilities (KSA) required for teamwork. Two, the paper argues that teaching these KSA's in the context of IS courses provides the best opportunity for IS students to gain these KSA's and presents one method for integrating teamwork training into IS courses. Three, the paper presents current research into the effectiveness of our approach to teamwork training.

The paper is organized as follows. First, the importance of teams is discussed. Next, we examine what KSA's are necessary for effective teamwork. Then, the question of where teaching teamwork fits into the curriculum is examined. This is followed by an example of how the explicit teaching of teamwork is being integrated into the IS classroom. Next is a field experiment designed to test the effectiveness of the approach described, including results from the control phase of the study. Finally, conclusions are drawn.

THE IMPORTANCE OF TEAMS

As society enters the third century of the industrial revolution organizations are re-evaluating how they perform their core functions (Hammer & Champy, 1993). As such, some organizations have collapsed their management hierarchy by restructuring or downsizing (Kettinger & Grover, 1995). One response to these organizational activities has been to replace some of the existing hierarchical management structure with self-managed work teams (Whitfield,et al. 1995). Teams offer an opportunity to bring together individuals with the abilities necessary to complete a va
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iety of projects -- both short and long term. Developments such as new technologies and the globalization of competition make teamwork increasingly important (Salas, et al., 1992). As tasks become increasingly complex, accomplishing these tasks imposes demands, both physical and mental, that are simply too complex for a single individual to perform in isolation.

Teams also provide the same social function that the organization does in that they allow individuals to accomplish more than they can by themselves. As one group of researchers asserts, "teams form to tackle goals beyond the reach of individual members" (Brannick, Roach and Salas,1993, p.287). Goals and tasks which exceed the knowledge, skills and abilities of any given individual, no matter how competent, are likely to occur with increasing frequency given the incredible growth of technology and technical knowledge (Larson & LaFasto,1989). A collection of individuals working interdependently toward a common goal may be well suited to complete especially difficult tasks with higher quality than individuals working separately. The complexity of a problem invariably increases with the importance of the problem to the whole organization, society, or country (Larson and LaFasto, 1989). This implies that the most important decisions are better made by a team than by an individual as individuals will have a difficult time being mindful of all important considerations and implications.

Teams have the potential to bring together several different viewpoints, all of which may make important contributions to critical decisions. This is, of course, dependent upon the selection process. Teams selected for homogeneity of members may have radically different outcomes than teams selected for heterogeneity of members. Janis (1982) has suggested that heterogeneity of viewpoints, among a number of other factors, may contribute to higher quality in decision-making (at least in consensus formation). It has been proposed that the most important innovations and ideas are no longer within the realm of the individual--they now require a team (Larson and LaFasto,1989). In fact, each individual member of the team must contribute some unique and relevant ability and knowledge to the task (Tziner & Eden,1984). Through compensation, a team functioning well may attain high levels of productivity. Smith, Salas & Brannick (1994,p.3) put it best with this: "One of the key advantages of a team is that team members can compensate for one another's strengths and weaknesses by catching errors and correcting mistakes during decision making." This further emphasizes the advantage of divergent backgrounds and opinions.

A final advantage may be realized in worker attitudes and beliefs. Studies of autonomous and semi-autonomous work groups have indicated that they may increase both productivity and job satisfaction (Carnall,1982; Rao, Thornberry & Weintraub,1987). The literature on teams holds similar conclusions (Gladstein,1984; Hackman, 1987). Sociotechnical theorists suggest that team membership may serve to increase workers' dignity, self-worth, commitment, and sense of purpose and reduce alienation (Carnall,1982; Rao et al.,1987). In most organizations, this will be a secondary consideration at best. However, an intervention that will bring benefits to both the organization and the individual seems superior to any offering benefits to one or the other.

Not only have teams become more important to organizations in general (Gordon, 1992), but teams are also widely used in the IS world. Teams are related to IS in at least two ways. First, information systems must support teams (Barua, et al., 1995). While this is an important topic, it is not considered in this research. More important to this paper is the fact that teams are widely used as an organizational form for IS development (Abdel-Hamid & Madnick, 1991; Ford & McLaughlin, 1992; Phan, et al., 1995).

Employers translate the importance of teams into a desire for certain skills in employees. In a survey of recruiters of recent IS graduates, teamwork related skills were among those rated as being most important (Van Slyke, Kittner & Cheney, 1997). A recent issue of ComputerWorld's Student Issue publication includes an article specifically discussing the importance of teamwork and communication skills (ComputerWorld Careers Edition, 1997).

IS educators must prepare their students for the increasing popularity of teamwork. The IS\'95 Curriculum Guideline notes that graduates should have the ability to lead and facilitate teams (Cougar, et al., 1995). Other researchers have also noted the importance of integrating teamwork instruction into IS and business education (Alavi, et al., 1995; Feller, 1996)

The importance of providing IS students with the knowledge necessary to function effectively in teams is well established. However, little research has been performed concerning how to accomplish this. Fellers (1995) provides an exception and gives advice on how to implement teams as part of a cooperative learning environment. However, Fellers does not include the explicit teaching of teamwork KSA's among his recommendations. This paper provides a specific method for teaching these KSA's and for integrating this teaching into IS courses.

If IS educators are to provide instruction into effective teamwork, we must understand what knowledge, skills and abilities must be gained by our students in order to make them effective team members. The next section discusses this issue.

REQUIRED KNOWLEDGE, SKILLS AND ABILITIES FOR EFFECTIVE TEAMWORK

Stevens & Campion (1994) provide a thorough treatment of the KSA requirements for teamwork. The brief discussion here is drawn from their work, except where noted otherwise. Readers interested in more detail on this topic are directed to the original article.

The KSA requirements for teamwork can be broken down into two broad categories--interpersonal KSA's and self-management KSA's. Interpersonal KSA's include KSA's for 1) conflict resolution, 2) collaborative problem solving, and 3) communication. Self-management KSA's include 1) goal setting and performance management, and 2) planning and task coordination (Stevens & Campion, 1994). Each of these is discussed in more detail below.

Interpersonal KSA's

Conflict resolution: One of the advantages of working in a team is that the team can make better decisions than can the individual. In order for this to occur, a certain amount of conflict is desirable--disagreement leads to a variety of decision solutions being identified and considered (Brockman, 1996). In order to work as an effective team, members must posses the KSA's necessary to recognize both desirable and undesirable conflict and to encourage the desirable and discourage the undesirable. In addition, the team must have the KSA's to be able to identify the source, as well as the type, of conflict the team is facing. The KSA's to execute an appropriate resolution strategy is also required. Finally, the team must be able to effectively use a win-win, rather than a win-lose, negotiation strategy.

Collaborative problem solving: The team must gain the KSA's to be able to identify situations that are appropriate for group problem solving. It is also important to be able to use the right type and degree of participation. Additionally, the KSA's to recognize barriers to collaborative problem solving and to take the proper actions to overcome those barriers are necessary.

Communication: Several communication KSA's are required for effective teamwork. These include the KSA's to:

1) understand communication networks,
2) communicate in an open and supportive manner,
3) listen actively and nonevaluatively,
4) maximize the agreement between verbal and nonverbal messages,
5) interpret other's nonverbal messages, and
6) recognize the importance of and engage in small talk and ritual greetings.

Self-Management KSA's

Goal setting and performance management: Teams must posses the KSA's to enable establishing specific, challenging and acceptable team goals. They must also gain the KSA's to engage in effective performance monitoring, evaluation and feedback, both in terms of the individual member and of the team as a whole.

Planning and task coordination: If they are to be effective, teams must gain the KSA's to be able to coordinate activities and information. In addition, they must recognize task interdependencies. Teams must also have the KSA's properly balance the workload of various members and to set role and task expectations.

The KSA's discussed above were used in establishing course material including lectures and handouts used in teaching teamwork.

TEAMWORK TRAINING IN THE CURRICULUM

As noted earlier, the importance of training in teamwork skills is important, and in the last section we delineated the knowledge, skills and abilities necessary for effective teamwork. The final issue to be considered , which is addressed in this section, is how to integrate the teaching of teamwork into the curriculum.

Although many courses in the IS and business curriculum may use team projects as an integral part of their makeup, it seems that there is little time allotted to teaching the necessary skills. In informal conversations with other IS educators at a number of institutions, the authors came to believe that most instructors, while agreeing with the importance of teamwork skills, have not yet integrated explicit training on teamwork skills into their courses.

Where, then, can students learn how to be effective members of a team? In colleges of business, a number of courses employ team-based projects, therefore students do get exposure to working in teams. The situation is the same in many IS departments. Team projects are frequently an integral part of courses such as Systems Analysis and Design and Database. These projects certainly give experience in teamwork that is both valuable and necessary. However, in order to make these experiences richer, training in teamwork skills is necessary. Anecdotal evidence indicates that many students do not enjoy team projects. Most educators who employ these projects have heard many complaints about team conflicts, unproductive members and the like. Perhaps training in teamwork can teach students how to deal with teamwork in a positive, rewarding fashion. In the next section, we describe one method for explicitly teaching teamwork training skills in the IS classroom.

A METHOD FOR TEACHING TEAMWORK SKILLS

The proposed method for teaching teamwork skills in the context of IS courses includes five components:

1) class lecture and discussion sessions,
2) a teamwork handout
3) in-class collaborative exercises,
4) a team-based project, and
5) monitoring of the teams by the instructor.

These components are designed to be interrelated--all components work together to move the students toward acquiring the required KSA\'s discussed earlier. This section details the components.

Lecture and Discussion Sessions

The first lecture and discussion session on teamwork should take place early in the term. The goal of this session is to:

1) make the students aware of the importance of team-related skills,
2) get the students thinking in terms of teams and teamwork, and
3) introduce the critical KSA's necessary for successful teamwork.

The basic structure of the session follows the teamwork handout (described below), which is given to the students at this time. Throughout the session discussion is encouraged by asking the students to relate the various topics to their own experiences. The session begins by stressing the importance of team-related skills. This is followed by a discussion on the nature of teams and team-based activities. Then, team and project organization is presented using the context of the team project. The session concludes with a discussion of a number of hints that can help the teamwork experiences. Although only one class session is devoted to teamwork, periodically throughout the term teamwork issues will be revisited and discussed in the context of other class activities.

Teamwork Handout

The teamwork handout is designed to reinforce the concepts discussed in the lecture and discussion session. It also provides the students with a document that they can refer to throughout the class. The handout was developed using the teamwork KSA's discussed previously as a guide. The intent is to include sections covering all of the KSA areas--conflict resolution, collaboration, communication, goal setting and performance management, and planning and task coordination. The teamwork handout is provided in Appendix A.

In-class Collaborative Exercises

At various points throughout the term, the project teams will work together on in-class exercises. These exercises serve multiple purposes. First, they give the team members additional time to get to know one another. They also provide additional experience in collaborative problem solving. In addition, the exercises present an opportunity for the instructor to observe the teams at work and to offer input on various teamwork issues. Finally, there is a side benefit of allowing reinforcement of subject ea topics through problem solving exercises that may be too large in scale for the students to complete on an individual basis.

Team-based Project

The team-based project represents a major opportunity for the students to put what they have learned about teamwork into practice. Completion of the project requires significant effort on the part of all team members as well as coordination of those efforts. The experience of the project provides students with considerable insight into all of the teamwork KSA's. In order for the project to be successful, the students must learn to resolve conflicts, collaboratively solve problems, communicate with each other, set goals and manager performance, and plan and coordinate tasks. However, the teamwork involved in this project is not the sink-or-swim proposition many such efforts represent. Students are aware of teamwork issues and have received training on effective teamwork. However, without the team project these may remain stale, distant concepts. With the project, the issues become very real and important to the team members. Readers who seek more information on the value of collaborative learning, including team projects, are referred to Feller (1996).

Instructor Monitoring

Throughout the term, the instructor continually monitors activities on the team project. For example, teams are required to turn in a project schedule. This deliverable is checked to verify that the team members understand and have reached consensus on goals and that they have engaged in planning and task coordination activities. In addition, teams that are having problems in other areas such as conflict resolution or communication will find it difficult to complete the schedule. This gives the instructor the chance to counsel with the team and guide them toward proper teamwork, thus further clarifying and reinforcing team KSA's.

It is of the utmost importance for the instructor to remain an active part of the teamwork experience. Without instructor monitoring of progress on the project and also in learning teamwork KSA's, the method described here stands little chance of success.

PROPOSITIONS AND RESEARCH MODEL

We propose that explicit teamwork training will have a beneficial impact on the students' perceptions of a number of factors. First, the teamwork training should enhance the students' perception of their team's success. Second, being introduced to teamwork concepts should also improve the students' perception of the value and benefits that accrue to those participating in teams. Third, the students' personal beliefs, or affectations regarding teams, should be enhanced by the teamwork training.

To measure the impacts discussed above, the post evaluation instrument developed by Fellers (1996) was administered to undergraduate sections of system analysis and design, and database. In addition, demographic information of age, years of full-time work experience and prior experience with teams was also obtained. The responses to the nine questions and demographics were compared between the two groups. No significant differences were observed, and the groups were combined for further analysis. In total, 89 responses were obtained.

The common factor model (Rummell, 1970) was used to examine this data set. To estimate the amount of common variance that exists within the data set, a number of alternatives have been proposed to estimate the communality of each variable, a measure of the common variance of any one variable (Rummell, 1970). Solutions include the maximum and average inter-variable correlation. Squared multiple correlations (SMC) between the variable in question has been shown to be both the minimum bound for the variables communality estimate, as well as a theoretical acceptable solution (Rummell, 1970).

Factors were extracted using the maximum likelihood technique (Rummell, 1970: Kim and Mueller, 1978). The existence of three factors was indicated by both the scree plot and Bartlett's $\chi 2$ (Rummell, 1970; Kim and Mueller, 1978). Therefore, a three factor model was evaluated using both the VARIMAX and PROMAX rotations (Rummell, 1970; Kim and Mueller, 1978). The PROMAX rotation, which contained the most simple structure (Rummell, 1970) generated the following factor matrix. The three factor solution matches the three factors stated earlier in the propositions.

TABLE 1

ROTATED FACTOR PATTERN

	Success	Value	Affect
Success in accomplishing outcomes	0.79700	-0.00417	0.07774
Success in working as team	0.88342	-0.02542	0.10493
Free of conflict	0.72004	0.01566	-0.21714
Comfort in team outcome being used for evaluation	0.72746	0.06795	0.07731
Valuable learning experience	0.16643	0.78052	-0.10637
Like to participate in teams in future	0.15213	0.56498	0.30472
Teams should continue in curriculum	-0.15341	0.89273	0.12070
Like teams above individual work	-0.07796	0.08468	0.76653
Like to participate in teams	0.02163	-0.02030	0.96997

Cronbach's coefficient Alpha (Cronbach, 1951) was 0.8787. This coefficient is a representation of the reliability of the interitem correlations of the overall instrument (Nunnally and Bernstein, 1994). Nunnally and Bernstein (p. 265) consider a coefficient alpha of 0.80 to be a standard of reliability.

This study uses a quasi-experimental design (Cook and Campbell, 1979), more specifically, the posttest-only design with nonequivalent groups (p. 98). The initial observation with the control group was obtained at the end of the Spring term, 1997. Treatment group results will be obtained at the end of the Summer 1997 term. The control group learned about teamwork implicitly through their respective projects. The treatment group will be exposed to teamwork training sessions (see Appendix A) during the summer term.
Results from the control group are analyzed as follows. First, a clear initial factor emerged for team success, with questions 1-4 all loading greater than 0.70 on this factor. This factor was moderately correlated with the both of the other two factors at 0.42.

The second two factors were correlated at 0.60. The first of these, loading on questions 5-7, can be interpreted as the overall value of working in a team environment. The correlation between this and the final factor representing the individual's personal affections is logical. The student sees value in working in the team environment, which relates to their individual goals.

CONCLUSIONS

Students in information systems courses commonly work on projects which require teams. We propose that students will benefit from instruction and training on teamwork issues. We anticipate that there will be benefits across three separate dimensions: the overall success of the team, the value of working on a team, and the individuals perceptions of personal benefits from engaging in the team process.

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APPENDIX A

EFFECTIVE SELF-MANAGED TEAMS

IMPORTANCE OF TEAMWORK SKILLS

As you build your skill set in anticipation of a successful career in IS, you should be aware that employers value "soft" skills as much or more than they value technical skills. In a recent survey of employers who hire entry-level IS graduates, teamwork skills, the ability to work with others, and the ability to work in groups were among the most desirable skills with ratings of 4.5 or above (a rating of 5 indicates that the skill is critical).

System development teams are becomiong more and more popular with industry. Most of you an expect to be a member of a team in the course of your career. By paying attention to the guidelines in this document, you can make your team project experience rewarding and valuable.

SELF-MANAGED TEAMS

Self-managed teams, such as your project team, have several characteristics that distinguish them from other types of groups and teams. These are discussed below.

Superordinate goals: Teams are formed in order to accomplish some set of goals. In the case of your project team, the overriding, or superordinate, goal is to complete the project requirements in a manner acceptable to the instructor. This goal needs to be in the forefront of all team members minds at all times. Individual goals are discussed later.

Complementary knowledge, skills and attributes: Recognize that your team represents a unique set of individuals with different knowledge, skills and attributes (KSA). Understanding that everyone on your team is different is an important step toward building an effective team. Just as a basketball team has players who are good outside shooters and players who are good at rebounding, so does your team have members who are good at writing and members who are good at data modeling. When dividing up the work, be aware of these differences and assign tasks accordingly. Be careful here, however. The main purpose of the team project is for the student members to learn. By being involved with the data modeling part of the project, a member who feels uncomfortable with data modeling can become more skilled in that area. However, giving this person total charge of that portion of the project is not a good idea. Teaming them with someone who feels that they are good at creating data models gives both a chance to further their skills.

Resource control: Self-managed teams have control over the resources provided to accomplish the project goals. In the case of your project team, your major resources are time and the team members' labor. Although you are required to hand in task assignments to your instructor, your team has total control over how those assignments are made--the instructor simply wants to make sure that the assignments have been made and that no major tasks are missing. Your instructor can also provide insight into how much time and effort is involved in completing various tasks. The team is responsible for seeking this guidance and for managing time by planning meetings, meeting milestones, etc.

Individual goals: One of the most important tasks for managers is to bring individuals' goals into congruence with the organization\'s goals. The situation is similar with self-managed teams. Although there is no formal manager, there are team and individual goals and individuals must find a way to achieve their individual goals, while still attaining the team's goals. Even though every member will have a unique set of goals, we can assume that most members will have at least three, 1) to learn course material, 2) to gain interpersonal and teamwork skills, and 3) to get a good grade.

Let's tackle these in reverse order. In order to get a good grade, your team must perform well. In order for the team to perform well, the team members must do two things--they must each perform well, and they must function as a unit. So, by working together, and by each member pulling their load, individual team members can accomplish their goal of getting a good grade. Accomplishing the second goal, to gain interpersonal and teamwork skills, can be helped by 1) thinking about teamwork, and 2) being an active member of the team. Thinking about teamwork involves giving real thought to the issues raised in this document and to the teamwork process. You will find that in the course of completing the team project you must compromise on some items in order for the team to do well. Being an active member of the team means completing tasks assigned to you and providing *constructive* comments to other members of the team. The final goal, learning the course material, can be achieved by following the above advice and, of course, by staying up with the rest of your course work. The project is designed to reinforce the concepts discussed in class. If you don't participate in class, complete assignments and read the text, you won't benefit from the reinforcement available in the project, and you probably won't be a very valuable team member.

Notice from the discussion above that the goals are interrelated. By accomplishing the goal of learning the course material and by concentrating on gaining teamwork and interpersonal skills the possibility of receiving a good grade increases dramatically. Notice also that these goals are not in conflict with the superordinate team goal of completing the project in a satisfactory manner.

Individual rewards: In self-managed teams a portion of an individual's reward is based on team performance. In this class, your external reward is your grade in this class. As the syllabus notes, 25% of your course grade comes from your team\'s project grade. To put it another way, your performance as a team has a significant impact on your individual reward--your grade.

TEAM AND PROJECT ORGANIZATION

If your team is to be successful, it must be organized. There are two aspects to this organization, team and project. Both are discussed here.

Team Organization

Initial team meetings: As soon as you know who is on your team, you should get together to exchange basic information including names, phone numbers, and email addresses. In addition, you should find out each member's preferred contact method (phone or email), meeting times and meeting locations. You will be given time in class to hold this initial team meeting, but little additional in-class time will be available for team meetings.

The next team meeting should take place one or two days after you receive the actual project. Two products should come from this meeting, an initial task list and a preliminary project schedule. These are discussed in the section on project organization. Also, this meeting provides an opportunity to get to know each others' knowledge, skills and attributes. Find out who enjoys writing, who is good at organizing, etc.

Written record: A written record should be kept of each meeting. This record should focus on decisions made by the team. You may also want to briefly state the reasons for arriving at particular decisions. If you fail to keep this record, you will find the team considering the same issues over and over because the team won't remember or won't agree on many decision reached earlier. It is important that these notes should focus on decisions made and the rationale behind them--not on the interpersonal disagreements that, in the long run, matter little to the project. This record should also note any changes made to the project task list, schedule or task assignments. Also, you will want to check off any tasks completed--always a good feeling.

Maintaining focus: It is critical for the team to maintain focus--*keep your eyes on the prize!* Your best friends in keeping this focus are the project schedule and manners (yes, like Mom taught you). Minimizing interpersonal conflict is crucial. Expect this conflict, it's a natural part of being on a team, but remember the overriding goal of doing a good job on the project. Disagreements on individual project components is actually a good thing--the project will be better for the effort taken in working these out. Disagreements rooted in interpersonal problems are a bad thing and should not be allowed to fester. Review these conflicts in terms of the project tasks, not in terms of personalities. Following the hints presented later can help your team accomplish this.

Project Organization

Task list: The task list requires that all members read the project and be prepared to share their take on what tasks need to be accomplished in order to complete the project. While this task list is likely to change over time, your team needs to agree on this initial list of tasks. Once agreement has been reached, the task list needs to be recorded and copies made for each member.

The task list is one of the most important project management tools your team will have. Remember that big problems are solved by taking a series of steps. (This is the point of systems analysis.) A marathon is completed one step at a time. If you only look at the enormity of the overall project and don't break it down into manageable steps, the magnitude of the project will seem insurmountable. By breaking the project down into tasks, the project suddenly seems easier.

Project schedule: The second product to come from your second team meeting, a preliminary schedule, is derived from the initial task list. In order to come up with a project schedule, the team must add times and priorities to the task list. The first step is to establish the priorities of the various tasks. Some of these will be obvious, others will not. Keep in mind that some tasks require other tasks to be completed before they can be started. For example, most tasks depend on the requirements statement being complete before they can be started. Also remember that some tasks can be done in pallel. Perhaps one team member works on the project write-up while another does report prototypes. Once you understand these priorities, the team needs to come up with the time required to complete each task. When this is done, start from the phase due date and work backwards to determine the milestone for each task. Be sure to put in some slack for unexpected delays. Once these steps are done, your project schedule is complete. Your instructor can review the schedule.

Task assignments: Assigning tasks to individual team members is critical to a successful project. Several factors should be taken into consideration. First and foremost, consider which team member(s) has the proper skills to best complete the task. Although for this project all team members should be capable of performing every task, some members will be better suited to particular tasks than others. Also, consider balancing the work load. Don't overload any one member with more than he can handle--this will only result in missed deadlines and unnecessary anxiety. Make sure each team member takes other class work into account when deciding whether or not she can meet a given deadline. You should also be sure to allow for peer review (described below). You are required to hand in task assignments to your instructor who may offer you some suggestions, although the team is ultimately responsible for making and sticking to task assignments.

Peer Review: One of the advantages of working in a team is having someone to review your work. In order to take advantage of this, you should assign one or two members to review each task output. For larger tasks, such as completing the ERD, two members should be assigned as peer reviewers while one may be sufficient for the review of other tasks. Be sure to allow sufficient time in your schedule for the peer review and for revision of the output. Following this recommendation can significantly increase the quality of your project ... *and your grade!*

A HANDFUL OF HINTS FOR EFFECTIVE TEAMS

- **Assume the best in people**

  Most problems are not the results of malicious intent, but as a result of our frustrations, we start to see problems as being the result of intentional actions on the part of others. Fight this urge. Your team members share many of your goals and, being reasonable people, want to accomplish those goals. The ability to rise above interpersonal differences and focus on the task at hand is a mark of a good team. Make the assumption that your team members did the best they could and work on ways to improve the situation so performance can also be improved.

- **Focus on the task**

  Make every decision, judge every result, resolve every conflict in terms of the task. Putting everything in terms of the task at hand will provide a structure and basis for making decisions and planning actions. This also prevents the team from getting off track.

- **Establish regular meetings**

  To avoid miscommunication, establish a regular time and place for team meetings. In these meetings you should 1) provide updates on task progress, 2) discuss any problems that individuals may be having with their tasks, and 3) update the task list and schedule if needed. By holding these meetings, everyone can stay on the same page and problems can be dealt with while they are still relatively minor.

- **Handling negative feedback**

  It's important to fix the problem, not the blame. Blaming a particular member does little good. It's usually more productive to 1) solve the problem and 2) establish ways to avoid a recurrence of the problem. A criticism should be viewed as an opportunity for improvement. The best in any field work on their weaknesses so negative feedback is simply an opportunity for the member and the team to become stronger. It's also important to focus not on the individual but on the task at hand. Frequent feedback (both positive and negative) is important. This can establish an atmosphere of mutual coaching.

- **Focus on behaviors**

  Behaviors are easier to modify than are attitudes. Saying "You're a lazy jerk" to a team member may reflect a fact, but it is unlikely to result in any benefit to the team. Instead, focus on the behavior that needs to be changed; "The team needs you to complete your tasks on time. What can we do to help you accomplish this?" This approach lets the team member become more effective and also display's the team's willingness to help.

- **Positive feedback**

  Remember that you are all managers, and a good manager recognizes good performance. When a member performs well, other members should be sure to praise that effort. This both reinforces positive actions and also softens the blow of any later negative feedback (i.e. criticism).

- **Dealing with failures**

  Your team is going to have occasional failures; expect them and see them for what they are-- an opportunity for improvement. The team should accept responsibility as a team and should look for ways to avoid such failure in the future. If handled properly, a mistake should not be repeated.

- **Ask for help if you need it**

  This suggestion applies to individuals and to the team. Individuals who find changes in their circumstances should ask their team members for help before the problem becomes insurmountable. Don't wait until two days before the project is due to inform your team of problems in completing your assigned tasks.

  The team as a whole should not hesitate to ask for input from the "manager" (your instructor). Going to someone outside the team does not mean that the team is incompetent. Remember that you are in a learning situation--the sole purpose of the team project is for you to learn. If the team is unable to solve a problem, ask the instructor (who will, of course, politely inform you if the team needs to put more effort into solving the problem).

- **Involve everyone**

  Teams often have both mice and loudmouths. Input from both is valuable so the team should strive to involve the mouse and to prevent the loudmouth from dominating. Ask quiet members for their input and ask more vocal members to summarize their views. Each team member should also contemplate whether they are a mouse or a loudmouth and modify their behavior accordingly.

- **Dealing with deadlocks**

  Sometimes factions within the team will take opposing views. Among the more useful strategies is to have each side debate from the other's point of view. Another suggestion is to point out common ground and look for a possible alternative strategy. Remember to view these disagreements in light of the overall task. Most important of all, limit the time you spend on deadlocks for relatively unimportant issues. For example, deciding what color to use for input screen text is not worth a two-hour debate. Flip a coin and keep moving toward the finish line.

- **Communicate actively**

  Communication takes two. Responsibility for effective communication is shared by the sender and the receiver. The sender is responsible for expressing ideas in an effective manner. The receiver is responsible for actively trying to understand the message and for seeking clarification if necessary. Only through active participation in the process can effective communication occur.

- **Focus on results**

Stay on track. Keep thinking about the overall goals of learning and producing a good project. Consult progress against the project schedule frequently--it should be a major focus of every group meeting. When faced with the inevitable hurdles that crop up, remember that there are overriding goals in place. Look toward the finish line, and the hurdles become smaller.

MANAGING INTRA-GROUP CONFLICT

- Don't let interpersonal conflicts escalate beyond control.

Just as a minor scratch can, if neglected, become infected, many problems and conflicts which begin as relatively minor irritations can fester into major issues when unresolved. Deal with difficulties when they are still minor and easy to resolve.

Try the following tips for conflict resolution:

A. Put the problem or conflict in perspective with the overall goal of the project.
B. Try to identify the common ground --the risks and benefits the sides have in common.
C. Give everyone a chance to air their point of view on any issues involving them.
D. If needs and expectations are unclear, ask clarifying questions.
E. Emphasize the common goal--to do a good job on the project.
F. Remember that the responsibility for resolving the conflict rests with the entire team.
G. One more time, deal with the conflict while it is still small and easy to resolve.

- Remember that a certain amount of conflict is healthy.

Many conflicts arise as the result of skilled people who care about the team\'s success--they simply have a difference of opinion. There is usually some right and some wrong on both sides. Taking the time to resolve the conflict often results in better ideas than if the conflict never occurred.

- Remember to respect the ideas of others.

Fight the urge to judge new ideas immediately. Being open to the ideas of others makes you and the team more effective. If only your ideas are valuable, there is little point in having a team.

- Use the following steps to resolve conflict:

1. Acknowledge the existence of the conflict.
2. Look for common ground.
3. Even if you don\'t agree, consider other points of view.
4. Develop a plan of action showing what each member will do to resolve the problem.

(Note: The above items are derived in part from experience and in part from two useful resources, the book *Tips for Teams: A Ready Reference for Solving Common Team Problems*, by Fisher, Rayner and Belgard, McGraw-Hill, 1995, and from Gerard Blair "Groups that Work" which is located at http://www.ee.ed.ac.uk/~gerard/Management/art0.html.)

NEW ROLES OF IS EXECUTIVES: A LEADERSHIP PERSPECTIVE

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Witnessing the radical changes in business environment and the innovative progress in technology today, organizations are increasing investment in IT and having more interest in people in charge of IS department. Definitely the roles of IS leaders are changing, and should be changed otherwise, toward the way they be well equipped not only with technical expertise but also with managerial skills and visionary leadership. Despite the recent increasing number of literature works on organization, leadership, or even CIO, it was hard to find studies which deal strictly and clearly with the changing roles of IS executives and their personal characteristics.

This article in progress is prepared to give a better understanding on the changing roles of IS executives, especially in light of the leadership skills and personality characteristics. The methodology applied here encompasses both the micro and macro views in that the study focuses on the individual, CIO, in the organization, along with the impact of changes in IT on that individual, and the impact of the behavior of the individual on the organizations overall performance as well.

INTRODUCTION

As information technology evolves, so do the management challenges and opportunities associated with it. The sharp decline in the cost of computing and the democratization of Information Systems (IS) have dramatically transformed the business use of Information Technology (IT) and inexorably altered the terms of competition in entire industries. Dynamic changes in markets, new demands from the consumer, and a stream of innovative technology applications have placed unprecedented demand on the leaders and managers of companies throughout the global economy, forcing them to redefine their most basic operating premises and reshape their organizations.

To cope with these changes, many organizations use IT quantitatively more and qualitatively differently. With this changing role of ITs in organizations, the role of IS executives, sometimes called Chief Information Officers (CIO), in organizations also should be changed. As Applegate and Elam (1992) point out, while in the "data processing era" of the 1960s, when IT served strictly support functions, it was acceptable for the IS leader to be a technical expert or competent manager. In the "information era of the 1990s", a new and expanded set of responsibilities demands that the IS executives also possess strong leadership skills, power, and business expertise. Since Ives and Olson (1981) called for management, and not technical, roles of IS leaders, a substantial body of research about the managerial role of the IS leader has begun to emerge. Until recently, however, IS executives assumed the role of functional managers who take the responsibility of selecting, managing, and maintaining IT. With the changing role of IT in organizations, however, IS executives must play a key role in adopting new technology, articulating visions of new organizations based upon new IT, changing the organization, and transforming people who are usually reluctant to change. Competent IS executives have become more important than ever before.

Despite the increasing importance of IS executives, however, there have been few studies on their changing roles. Furthermore, most existing studies on IS executives are lacking in theory. These studies describe new IS executives rather vaguely whereas organizations need specific guidance to recruit for one of their most critical positions.

Recent theoretical developments in leadership on "charismatic", "visionary", or "transformational" leadership shed some lights on new roles of IS executives (for example, House 1977, Burns 1978, Bass 1985, Howell and Frost 1989). The purpose of this research in progress is to identify the new role of IS executives based on this recent theoretical development in leadership literature. More specifically, in this proposed study we will investigate the appropriate leadership skills and personality needed for successful IS executives.

PREVIOUS STUDIES

Studies on IS Executives

Ives and Olson (1981) called for the study of the managerial role of IS executives. Synnott and Gruber (1981) used the term Chief Information Officer for the first time to emphasize the managerial role of IS executives. Rockart et al. (1982) predicted that future IS executives would be required to have an in-depth understanding of the business to complement their technical knowledge. Stephens et al. (1992) adopted a structured observation methodology employed by Minzberg (1973). In this CEO study which observed five CIOs, it was found that CIOs operated as executives rather than functional managers. Applegate and Elam (1992) compared newly appointed IS executives with established IS executives to identify new roles of IS executives. Their findings were consistent with that of Stephens et al. (1992).

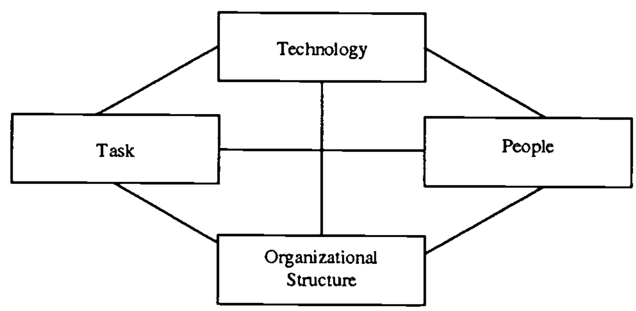
Even though these findings are all pointing to the fact that the role of IS executives is changing to accommodate the new role of IS in organizations, they don't specify what type of business or managerial skills would be appropriate for that position.

New Role of IT in Organizations

With the dramatic advances in computer hardware and software technology, now we can see more and more creative and innovative applications of IT in organizations. When the computer was introduced into the organization, only a few people thought it would change the way people work in organizations fundamentally. However, things have been changed since the mid 70's. With the revolutionary development in computer and telecommunication technologies, now we are seeing more creative and innovative ways of using IT in organizations. Furthermore, with these creative and innovative ways of using computers in organizations, we are now seeing fundamental changes in organizations under the impact of Information Technology (IT) which combines computers and communication technology.

FIGURE 1

LEAVITT'S DIAMOND



Leavitt's model of an organizational system, in which task, structure, people, and technology are interrelated and mutually adjusting, is helpful here. According to Leavitt's diamond, when technology is changed, other components of this diamond will respond to this change. To adjust themselves and to be effective there should be a "fit" among these four components. In this proposed study, we will focus on the "fit" between people, specifically IS executives, and the other variables of this model from the perspective of leadership behavior.

Charismatic Leader

In the mid 70's, there has been a major paradigm shift in the leadership area. With the mixed results of path-goal theory and other leadership research which mainly focused on the social exchange nature of leader-follower relationship, several leadership scholars started pay attention to the exceptional leaders who have extraordinary effects on their followers and eventually on social systems. According to Shamir et al. (1992), such leadership--alternatively called "charismatic", "visionary", and "transformation"--is claimed to affect followers in ways that are quantitatively greater and qualitatively different than the effects specified in past theories.

After an extensive review of literature in sociology, political science, and social psychology on "charismatic" leadership, House (1977) proposes "1976 theory of charismatic leadership". In that theory, he hypothesizes that leaders who have charismatic effects are differentiated from others by some combination of the four personal characteristics, such as dominance, self-confidence, need for influence, and a strong conviction in the moral rightness of his or her belief. Also, he hypothesized that charismatic leaders employ these characteristics with such behaviors as goal articulation, role modeling, personal image-building, demonstration of confidence and high expectation for followers, and motive arousal behaviors. Further, these behaviors enhance followers' trust, loyalty, and obedience to the leader which results in effective task performance if the aroused behavior is appropriate for their task demands.

Burns (1978) proposes the concept of "transformational leadership. In that, he defines transformational leadership as occurring when one or more persons engage with others in such a way that leaders and followers raise one another to a higher level of motivation and morality. Burns made distinctions between managers and leaders using leaders such as Gandhi and Roosevelt as examples.

Based on Burns' analysis of political leadership, Bass (1985) develops a model of leadership which generalized Burns' classification of transactional and transformation political leaders to a wide array of organizational settings. According to Bass, transformation leaders build on exchange relationship by developing, intellectually stimulating, and inspiring followers to transcend their own self-interests for a higher collective goal, while transactional leaders exchange rewards for services provided by followers.
House, Howell, Shamir, Smith, and Spangler (1993) expand House (1977) by incorporating the results of Shamir, House, and Arthur (1992) and House, Spangler, and Woycke (1991). Shamir, House, and Arthur (1992) provide a motivational explanation of effects of charismatic leader behaviors on followers' behaviors. On the other hand, House, Spangler, and Woycke (1991) embody the results of the personality research of McClelland and his associates into a charismatic leader behavior study. House et al. (1991) hypothesized that a certain personality profile, labeled the leadership motive profile, is related to charismatic leadership. Specifically, the charismatic leader is more likely to have a higher need for power, higher activity inhibition, and lower need for affiliation than the non-charismatic leader.

While the earlier theories describe leader behavior in terms of leader-follower exchange relationship, providing direction and support, and reinforcement behavior, the new leadership paradigm emphasizes symbolic leader behavior, visionary and inspirational ability, nonverbal communication, appeal to ideological values, intellectual stimulation of followers by the leader, high leader expectations for follower performance, high leader confidence in followers, and leader concern with her or his image in the eye of followers and other important constituents.

Further, the new theory argues that charismatic leaders transform organizations by infusing into them ideological values and moral purpose, thus inducting strong commitment rather than by affecting the cognition or the task environment of followers, or by offering material incentives and the threat of punishment.

Several studies have demonstrated empirical support for the theories of charismatic and/or transformation leadership. Sashikin, Rosenbach, Deal, and Peterson (1992) show that school principals who are transformational or visionary leader changed the culture of their school. They also reported that the students of those schools whose principals were identified as transformational or visionary showed higher

performance. In addition, they found that improvements in transformational leadership behavior would result in the perceived effectiveness of leaders' units.
Podsakoff, MacKenzie, Moorman, and Fetter (1990) show that transformational leader behavior has a positive impact on organizational citizenship behavior and the trust evidenced by subordinates moderates this relationship. In other words, they found that transformation leaders cause followers to do more than they are expected to do and perform beyond the level of expectation. This relationship, however, is indirect, rather than direct, in that it is mediated by followers' trust in their leader.

Halter and Bass (1988) show that transformation leader behavior obtained from the rating of their subordinates significantly differentiated top performing managers--identified as such through other sources, such as work-group performance criteria and ratings of superiors--from ordinary managers.

House, Spangler, and Woycke (1991) find that there are certain relationships between the presidential personality characteristics such as need for power, need for affiliation, and presidential power inhibition and performance and presidential charisma. Also they showed that there is a positive relationship between presidential performance and presidential charisma. In addition, they identified the positive relationship between presidential performance and presidential motives.

Howell and Higgins (1990) show that champions and non-champions in technological innovation can be differentiated on the basis of charismatic leader behaviors. Specifically, charismatic leadership behaviors that distinguish champions from non champions consist of expressing ideological goals, communicating confidence in others, displaying unconventional and innovative behaviors, showing environmental sensitivity, and displaying unconventional and innovative behaviors, showing environmental sensitivity, and displaying self-confidence.

Howell and Frost (1989) investigate the effects of charismatic leader behavior in controlled laboratory environments. They showed that under charismatic leaders, followers overcome group productivity norms and show higher task adjustment, task performance, and other necessary adjustments.

RESEARCH MODEL AND HYPOTHESES

Based on the preceding discussion the following hypotheses are developed to be tested.

H1a: IS executives who exhibit transformational leader behavior, that is, charisma, inspiration, intellectual stimulation, and individual consideration will be more effective than non transformational IS executives.

H1b: IS executives identified as "top performers" will be rated higher in transformational leadership factors than a randomly chosen group of "ordinary" IS executives.

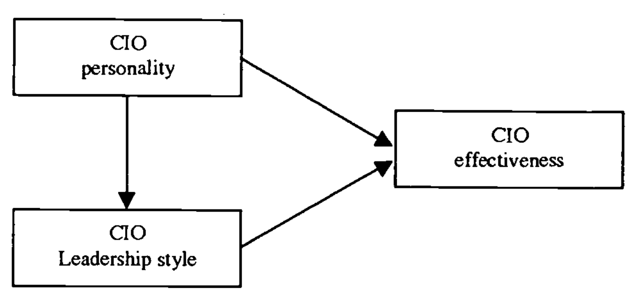
H2: Effective IS executives will exhibit higher achievement, persistence, innovativeness, persuasiveness, and risk taking than other IS executives.

H3: There will be a more positive relationship between personality dimensions and transformational leader behavior for effective IS executives than other IS executives.

The above theoretical arguments and supporting empirical evidences are combined into a single model of effective IS executives, shown Figure 2.

FIGURE 2

A GENERAL MODEL OF IS EXECUTIVE PERSONALITY, CHARISMATIC LEADERSHIP AND EFFECTIVENESS



RESEARCH METHODOLOGY

One of the potential weaknesses of this type of research is "same sample bias" which occurs when we use the same subjects to measure a set of different variables. Several steps will be taken to minimize this weakness. First, effective IS executive will be identified by peer review as well as review by a superior to whom IS executive usually reports. Secondly, leadership behavior will be assessed by direct subordinates who directly report to IS executive. Third, personality characteristics will be assessed directly by IS executives.

Path analysis using LISREL will be used to test our general model. Several additional statistical procedures will be employed to test the hypotheses.

MEASUREMENT

Leadership behavior

Leadership behavior will be determined using Bass's (1985) Multifactor Leadership Questionnaire.

Personality Characteristic

Three scales from the Jackson Personality Inventory (Jackson 1976) will be used for risk-taking, innovation, and social adroitness. In addition, we will use two scales from the Personality Research Form E (Jackson 1967) to measure achievement and endurance. Extensive empirical evaluation of these measures revealed a high internal consistency and test-retest reliability, minimal acquiescence and social desirability response biases, and adequate convergent and discriminate validity (Jackson 1967, 1976, 1977).

IS Executives Effectiveness

Measures to tap IS executives' effectiveness will be developed and tested. For the purpose of this proposed study, we will adapt the questionnaire from Halter and Bass(1988).

EXPECTED CONTRIBUTIONS

The expected contributions of this proposed study include: First, it is expected that we can identify appropriate leadership skills and personality characteristics for IS executives. This is a very important contribution to organizations because they can use our conclusions for guidance as they recruit IS executives.

Second, for the IS academician, this proposed study can help to build the messo theory of IS. Most of the existing IS studies can be categorized as either micro or macro research. While micro approaches focus on the impact of individual applications on individual people or a group of users, macro approaches focus on rather broad topics such as the strategic impact of IT structures. In micro studies it is hard to find organization and IT architecture, while in macro studies individual people and IT application hardly exist. There are few studies, if any, which truly combine these two approaches. This rather sharp distinction between these two different approaches becomes one of the major hurdles for building a concrete identity of IS research. To overcome this obstacle, we need to have a messo theory of IT which links micro and macro research. This proposed study is micro in the sense that its main focus is on the individual, CIO, in an organization and the impact of changes in IT on that individual. This proposed study is also macro as well, since the consequences of behavior of that individual has a significant impact on the organizations overall effectiveness. In other word, the unique position of CIO which connects individual IT into overall business performance allows us to build the messo theory of IS on the top of it.

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THE IMPACT OF A COMPUTER BASED INFORMATION SYSTEM (CBIS) ON FOREIGN INVESTMENTS OPPORTUNITIES

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The purpose of this paper was to analyze the impact that Computer Based Information Systems (CBIS) could have on United States (U.S.) Multinational corporations operating in Canada and particularly the province of Quebec and the implications for the North American Free Trade Agreement that came into effect on January 1, 1994. The study focused on how the data processing, internal audit, and financial intelligence subsystems of a financial information system, can affect the success and viability of foreign investments. The study showed that when the Management Information Systems (MIS) are viewed as an organizational resource, the Financial Information Systems (FIS) must be properly designed and implemented so that financial goals of the foreign subsidiaries, and that of the parent company are communicated to the appropriate responsibility levels within the organizational hierarchy through the output subsystem.

INTRODUCTION

The world of the 1990s is certainly very different from that of the 1980's, it requires shifts in management and thinking. Companies' capabilities and constraints have changed, and so have assumptions, methods and solutions that served well enough in the past decades. With continuing advances in computers and telecommunications, managers will have to shape organizations that respond quickly to foreign investment opportunities.

According to Deputy Assistant Secretary Ann H. Hughes, On January 1, 1989, the United States (U.S.) and Canada formed the world's largest free trade area, stretching from the Arctic Circle to the Rio Grande. Not only did this historic U.S. - Canada Free Trade Agreement (FTA) cover bilateral trade in goods and services, but also investment (Business America,1989.) FTA represented a total market of about $ 80 billion dollars a year. FTA has affected every province in Canada. One of the provinces that benefited significantly in the FTA is the Province of Quebec, Canada.

Quebec's economy is expected to continue to grow. There appears to be a strong sense of confidence in Quebec's business community, fueled by Quebec's good economic performance and the prospect of free trade with the U.S. and Mexico (Lindzon, 1992)

The Province of Quebec, Canada border on the province of New Brunswick and the States of New York, Vermont, New Hampshire and Maine to the South. It borders Labrador to the East. Ontario and Hudson Bay lie to the West and the Northwest Territory lies to the North and West. Quebec has a population of about 7 million with a geographic area of 1.7 million sq km. It is 3 times larger than the area of France. About 81% of the Quebecers speak French, 9% speak English and 10% speak other languages. (Balogun, 1988)

The Free Trade Agreement (FTA) took effect on January 1, 1989, after the U.S. Congress and the

Canadian Parliament had agreed to implement the legislation. The purpose of the FTA was to remove trade barriers and stimulate investment opportunities between the two countries.

New legislation called North America Free Trade Agreement (NAFTA) take effect on January 1, 1994. The purpose of the NAFTA was to remove trade barriers and stimulate investment opportunities among the U.S., Canada and Mexico. The economies of these three countries will be united into the worlds, larget market of our time. Business acquisitions will be allowed without government screening, tariffs will be eliminated or greatly reduced. NAFTA trading zone will serve about 370 million consumers with a combined purchasing power of more than $ 6.5 trillion (VSCPA,Disclosures, 1994.)

In analyzing investment opportunities in foreign countries, one must consider the roles played by management of the host and that of parent countries, in maintaining effective and efficient operations. These roles must include the impact Management Information systems (MISs) will have on foreign operations.

International financial managers often manage by relying largely on various types of information and other environmental factors. Information by definition is the collection and processing of relevant data for managerial decision making. Multinational managers, therefore, must typically require an expanded and more sophisticated information set than their domestic counterparts. Management information systems take into considerations the environmental complexities vis-a-vis the management roles. These environmental factors are government, financial community, cultural, legal constraints and competitors which impact directly on the day-to-day operations of a foreign subsidiary. Along with the environmental complexities are the roles played by management to assure that the foreign subsidiary achieves their stated goals and objectives. According to (Howard & Perlmutter, 1969), these are the traditional management functions: planning, organizing, staffing, motivating and controlling. The economic situation in the world is changing and MNCs have realized that the use of MISs as part of their planning process will bridge the gap between potential and performance in MIS applications (Goodwin, 1991.)

Modern economies are complex, interconnected systems that can be changed by applying information technologies (IT). Whether financial information is viewed as a resource or as a commodity, according to study done by Lindzon, (1992), MNCs doing business in Quebec are increasingly affected by the rules that govern its flow and use. The rules that govern international flow of financial information will determine the decision-making procedures (Krasner, 1983) actual and potential effects on IT used by U.S. MNCs.

As a result, several firms in Quebec are considering joint ventures and license manufacturing with several U.S. firms, requiring the development and use of a complex Computer Base Information System (CBIS).

THE CBIS AS FRAMEWORK FOR ANALYSIS

According to (McCleod, 1996), the CBIS contains five subsystems Data Processing (DP), Office Automation (OA), Expert Systems (ES), Decision Support System (DSS), and Management Information systems (MIS). The MIS when viewed as an organizational resource is part of the CBIS umbrella for all business applications. Under the CBIS umbrella, the MIS represents organizational efforts to apply the computer as an information resource for decision making concerning, marketing, manufacturing, human resource, and finance.

Since the 1989 FTA with Canada, U.S. firms have gained experience in implementing joint international company-wide functional MIS designs, and are ready for managers in certain functional areas to begin applying the concept to their own needs. In order to provide information concerning the money flow to users throughout the firm, the MIS must contain a subsystem called the Financial Information System. This system within the MIS is a concept and is viewed as one of the firms functional areas. The Financial Information Systems should be the heart beat of most MNCs. Its IS technology must be the controlling factor for solving problems before and after they exist within the firm.

A good example of the importance of the conceptual financial Information system is provided by Lee Iacocca, describing the situation at Chrysler when he became chairman in 1978:

> "A couple of months after I arrived, something hit me like a ton of bricks. We were running out of cash! Gradually, I was finding out Chrysler had no overall system of financial controls - nobody in the whole place seemed to fully understand what was going on when it came to financial planning and projecting. I couldn't find out anything. This was probably the greatest jolt I've ever had in my business career. I already knew about the lousy cars, the bad morale and the deteriorating factories. But I simply had no ideal that I wouldn't even be able to get hold of the right numbers so that begin to attack some basic problems." (Newsweek, 1984).

The influence of communication technology on organizational structure has changed and the focus will be on project management integrating users and data (Hauptman & Allan, 1987).

Moreover, Sears Canada, a MNC doing business in Quebec could not maintain its financial health, without a financial information System being part of its MIS.

The perplexing issue of distance faced by MNCs management can be eased through the use of telecommunications. However, the communication between the parent company and its subsidiary becomes extremely tedious when the information flows through many channels that are thousands of miles apart. More succinctly, information flow must deal with cultural and language interpretations. A case in point is the foreign operations in Quebec. Since Quebec is a French speaking province, the provision of timely information, which often is written in English from the parent company often relies on the use of output from a financial input subsystems where internal auditors give workable recommendations on how to deal with the great diversity of external conditions that bear upon financial decisions of a foreign subsidiary. Large firms usually have a staff of internal auditors who periodically study the firm's conceptual systems to insure that the integrity of the data is maintained.

INFORMATION FLOW PROBLEMS

Business information flows have traditionally assumed a vertical mode in the organizational hierarchies, i.e., information moves from lower to higher management echelons and conversely. Therefore, international managers are mainly concerned with the type and quantity of information they receive and the source in which the information originated and processed before ultimately channelling the data to the users. One must be aware of the potential for information overload when using the conceptual Financial Information System, where an excess of information is available and forwarded to the managers through the use of forecasting, funds management, and control output subsystems. The situation is even more precarious for multinational managers who are often confronted with information overload and at the same time are asked to make instantaneous decisions that will affect the local operations of the company as a whole (Certo, 1992.)

There are rules for the international flow of information. As the financial information requirements grow, issues such as privacy, intellectual property rights, telecommunications, and trade have to be resolved through global cooperation among the U.S. and Canada. Sector specific principles are critical (Mashatt, 1989) when enhancing telecommunications-network-based services. The FTA does not change the right of either country to allow monopolies in basic telecommunications services. However, it recognizes that these services are essential for marketing of many other services, like electronic mail. The FTA guarantees companies who need to use basic telephone services the right to connect to and use those services. All computer services, such as software and computer leasing and rental services, which do not necessarily use basic telephone services as their means of distribution to customers, are granted rights under FTA legislation (Mashatt, 1989.)

TRANSLATION/TRANSPOSITION PROBLEMS

Another major information problem is the question of the translation or transposition from one information code to another, i.e., from English to French. In appraising the performance of a foreign subsidiary, U.S.

managers generally express a preference for management reports stated in English and the foreign currency is also translated to U.S. dollars. In every translation, some cogent and relevant information may be lost due to translation or transposition problems. In fact, it may be impossible to translate word-for-word a management report from English to French. Evidently, the French speaking manager receiving a report so transposed may not receive the same message (information content) the financial manager in the U.S. would receive on the basis of the original report. This factor makes a lot of difference in the information content of transmitted messages (Daley, 1985).

Multinational information flows must be premised upon a solid basis on which foreign subsidiaries must operate. Such premisses are policy decisions of the parent company. According to (Perlmutter, 1969), in analyzing investment opportunities, the parent company must classify multinational organization policies.

FINANCIAL CONTROL PROBLEMS

The MIS will be ineffective and inefficient without the proper management of the financial information systems designed and implemented for both domestic and foreign investments. By the same token, the financial information system control subsystem must be designed and properly implemented so that financial goals of the company can be communicated to the appropriate responsibility levels within the organizational hierarchy. Such a well-designed financial information system subsystems should include a control subsystem that enables the company to evaluate the degree to which established objectives are being achieved and the corrective actions that are being taken when actual performance deviates from standards. Its functions should include measurement, communication, evaluation and motivation. Also, providing information on the annual operating budget, actual expenses are important. Cultural and language attributes must be intricately considered and properly evaluated so as to make the control subsystem work effectively and efficiently.

According to the research study, Analyzing Quebec Investment Opportunities: Accounting Decision Making for Multinational Corporations (Balogun ,1988), some U.S. firms operating in Quebec suggested that there are cost advantages to transplant as much of the control subsystem to Quebec as possible. Some international managers in Quebec further pointed out that many managers are familiar with the foreign subsidiary's MIS. As a result, the use of identical financial control subsystems internationally will achieve uniformity in the organizational financial information systems. However, since one of the objectives of the financial information system is safeguarding enterprise assets, a CBIS with its hardware in either location could meet the organizational needs for both locations. The potential impact of environmental diversity on the financial information system cannot be overemphasized. Home management should seriously consider a method for designing and implementing financial control in its Quebec subsidiaries so as to achieve the MIS's objectives that are established for the organization.

In analyzing investment opportunities in Quebec, U.S. firms must adapt their MISs so that they contain a financial intelligence input subsystem in order to gather information on various industrial features and characteristics, and environmental elements that influence the money flow. The Financial Information System pictured in Figure 1. is designed to gather industrial features and environmental data and information.

FIGURE 1

FINANCIAL INFORMATION SYSTEM

INPUT SUBSYSTEMS

[Data processing] >>> <<< Internal audit [Financial intelligence]

|

Data base

|

OUTPUT SUBSYSTEMS

[Forecasting Management] Funds [Control]

|

MNCs' User

The data processing input subsystem performs the firm's data processing tasks of gathering data that describes the firm's activities, transforms the data into information, and makes the information available to functional financial managers.

In evaluating the profitability, efficiency and effectiveness of foreign investments, the parent company must get score keeping, performance evaluation, and problem solving to the internal audit subsystem. These are traditionally the roles of management accounting. Internal auditors are sent to the foreign subsidiaries to assess the quality of operations and the status of a going concern. This information in part is gather and stored in the internal audit subsystem.

MNCs financial manager will need access intelligent information in order to manage their resources. Information from data such as: energy cost, exchange rates, industrial land cost, industrial building costs, manpower costs, the financial community, stockholders, and the government must be gathered from the environment using the financial intelligence input subsystem. All of the above data from environmental sources as well as internal sources should be stored in the firm's database. This information is critical, and must be processed and presented to financial functional area managers so the firm may have qualitative as well as quantitative information before making investment decisions.

Many MCNs which have tried to invest in foreign countries have realized that the key issue is the output subsystems of the Financial information system. The output subsystem contains information pertaining to forecasting, funds management and control.

Forecasting is used to predict what will tend to happen in the future by taking a look at what has happened in the past. Since the output used from the forecasting subsystem helps users make semistructured decisions, the decision support system is a great tool that supports this model. In the CBIS model, the managers from the functional areas can forecast short-term. However, long-term forecasting is usually done by an area other than marketing, by the financial function or by a special group that has planning as its only responsibility.

The management of funds is critical to the success of MNCs. The flow of money from the environment, through the firm, and back to the environment is important because money is used to obtain the other physical resources. The flow can be managed through the funds management subsystems output. Managers can be assured that the revenue inflow is greater than the expense outflow. The conversion from U.S. dollars to the foreign country's currency and vise versa, can be done before the output is presented for use.

The best way to control, is to use an operating budget. This bugget is used by managers to meet the operational objective of the company. The control subsystem can provide valuable ratio reports to the users. The CBIS has probably done a better job in the control area than any other. When an accurate and current database exists, it is a simple process to compare actual and budgeted expenses, produce reports, and compare ratios.

CONCLUSION

The pace of technological change exceeds the ability of many organizations to keep up with the versatility. Many MNCs today have realized the change and are using CBIS technology to prevent their operations from lagging behind in the foreign investment markets.

The impact that the CBIS can have on foreign investment is critical. That MNCs doing business in other countries, especially Canada, must have a CBIS that contains a Financial Investment Subsystem as part of their MIS is unquestionable.

The growth of CBIS technology offers MNCs the opportunity to improve the performance of their firms in the global market. The functional manager as end-user, can use the output from the CBIS to control day to day activities of the host country foreign firm.

The CBIS should become the dominant kind of computing for MNCs doing business in foreign countries, especially the NAFTA countries, and

MIS executives need such an approach for dealing with the demands of new foreign investment legislation such as NAFTA.

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END USER TRAINING: A DECADE OF RESEARCH

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End user training research has uncovered principles applicable to many forms of training and education. In an attempt to determine useful principles for IS educators, the top twelve MIS journals were systematically reviewed to locate all of the end user training articles that were published in those journals from 1980 to 1996. A total of twenty articles were found, spanning the decade from 1987 to 1996. These articles were divided into seven streams of research: training and user acceptance / satisfaction, training methods, trainee characteristics, the need for training, evaluating training, the training environment, and the organizational environment. The articles within each stream of research are discussed and the results evaluated. Possible directions for future research are given, and then some conclusions on the current state of end user training research are offered.

INTRODUCTION

Almost twenty years ago, a crisis was realized. Data processing departments were unable to meet the demand for their products, causing a backlog of IS's waiting to be developed (McLean 1979). McLean proposed that allowing end users to work as developers was the only solution with the potential to avert this crisis. With the growth in end user computing (GSA Office of Personnel Research and Development, U.S. Government 1995), researchers began investigating the issues associated with training end users.

End user training shares several similarities with IS education. In both cases, instructors are attempting to improve the students' skills at working with technology. Perhaps more importantly, in both cases these technology skills are being used by the students to develop systems that support organizational tasks (Brancheau & Brown, 1993). Based on these similarities, it appears reasonable that principles uncovered by end user training research could be used by instructors to further improve IS educational programs.

Considerable research has occurred in the area of end user training. Lamentably, there has been no systematic evaluation of the findings contained in these articles. This paper, therefore, reviews all of the training research published in the top twelve MIS journals since 1980. The published articles are organized into major streams of research and the findings from these articles are compared and contrasted to determine their overall contributions to IS education.

METHOD

Walstrom, Hardgrave and Wilson (1995) provided a recent ranking of the top MIS journals. The top twelve journals are listed in Table 1, in rank order of importance. The researchers searched through those twelve journals, looking for articles on end user training. Since the first end user computing article appeared late in 1979 (McLean), each issue in the selected journals from 1980 to 1996 was examined. Searching through the journals involved scanning the table of contents for each issue to determine whether any of the articles dealt with end user training. If there were any article titles that were questionable, the abstract was consulted to make a final decision.

TABLE 1

LISTING OF TOP MIS JOURNALS THAT WERE SEARCHED TO LOCATE END USER TRAINING ARTICLES

Journal	Code
MIS Quarterly	MISQ
Communications of the ACM	CACM
Information Systems Research	ISR
Management Science	MS
IEEE Trans. on Software Engineering	IEEESOFT
ACM Trans. on Database Systems	ACMTRANS
Journal of MIS	JMIS
Decision Sciences	DS
Harvard Business Review	HBR
ACM Computing Surveys	ACMCOMP
Decision Support Systems	DSS
Information and Management	INFO&MGMT

Unfortunately, some of the journal issues were not available during the search process.
Table 2 lists which issues were not searched, and the reason why they were excluded from the search process. It seems likely that the amount of coverage is nearly exhaustive; the issues which have not yet been searched may contain a few more end user training articles, but it is doubtful that those few articles would substantially alter the results reported by the rest of the articles.

The articles that were found in the selected journals were examined chronologically in an attempt to uncover trends within the past decade of training research. Those articles that considered conceptually similar aspects of the training process were placed into broad categories or streams of research. These categories provided a framework within which the results reported by the articles could be examined and compared to each other.

TABLE 2

COVERAGE OF THE SELECTED JOURNALS (ITALICS INDICATE COMPLETE COVERAGE)

Journals	Coverage	Comments
MISQ	1980-1996	The 12/96 issue is in the process of being bound.
CACM	1980-1996	
ISR	1990-1996	The first issue was in 1990.
MS	1980-1996	
IEEESOFT	1980-1996	
ACMTRANS	1986-1996	The issues from 1980-1988 were not in the library.
JMIS	1985-1996	The first issue was in 1985.
DS	1980-1996	
HBR	1980-1996	
ACMCOMP	1980-1996	
DSS	1985-1990, 1995-1996	The first issue was in 1985; the issues from 1991-1994 were missing.
INFO&MGMT	1980-1996	

RESULTS

A total of twenty articles were found that were published between 1980 and 1996. It appears that a steady rate of research (of about two or three articles per year) has occurred over the past decade.

These articles were placed into broad categories, given in Table 3, in an attempt to identify streams of research that have occurred within the past ten years. These categories enable one to compare and contrast the results from each of the articles, as well as determining the knowledge that has accumulated from these articles. This should allow researchers to determine where gaps still exist in our knowledge of end user training, and where researchers could most profitably direct their efforts in future research studies. Each of the rows in the table represents a different year from 1987 to 1996, allowing one to examine the chronological sequence of the research studies within each of the categories.

As can be seen in Table 3, the first empirical research was conducted in 1987 by Nelson and Cheney. They began one of the more popular research streams: a series of articles that attempted to link end user training with user satisfaction and acceptance. The only research stream that was more popular was one that attempted to compare various teaching methods. Some of these articles also examined the interaction between trainee characteristics and training method (Davis and Davis, 1990; Santhanam and Sein, 1994). The remainder of the trainee characteristics articles (Bostrom, Olfman and Sein, 1990; Mackay and Lamb, 1991) attempted to determine whether there were distinguishable groups of trainees that required different forms of training.

TABLE 3

CATEGORIZATION OF THE END USER TRAINING ARTICLES

Opinion	Training Accept. & Satisfaction	Training Methods	Trainee Char.	Need for Training	Eval. of Training	Training Environ.	Org. Environ.
Mdskr87	Nelson87						
	Cronan90	Davis90	Davis90	Cronan90			
			Bostrm90				
			Mackay91	Nelson91			
	Yavrbm92						
		Davis93					
		Ahrens93					
		Ngwenyma93					
		Snthanam94					
		Olfman94					
	Lee95	Compeau95		Nelson95	Carroll95	Galletta95	Fitzgrld95
	Simon96	Simon96	Simon96				

Nelson, after his initial article exploring the link between training and satisfaction (Nelson and Cheney, 1987), began a separate stream that attempted to provide a method for determining the users' need for training (Nelson, 1991; Nelson, Whitener and Philcox, 1995). Cronan and Douglas (1990) and Carroll and Rosson (1995) examined methods for evaluating the effectiveness of training. Galletta et al (1995) and Fitzgerald and Cater-Steel (1995) looked at the context surrounding the training to determine whether it had an impact on the training's effectiveness.

Training/Acceptance/Satisfaction

Nelson and Cheney (1987) correlated hours of training with measures of ability and information systems (IS) acceptance from the results obtained by surveying managers and professionals. They found a significant positive correlation between training and ability, but the correlation between ability and acceptance was nonsignificant. This contradicts the later findings of Lee, Kim and Lee (1995) who found a significant path between ability and acceptance when using path analysis on data collected from structured interviews with managers and questionnaires completed by end users. However, a closer examination of the measures used by the two different papers reveals the probable reason for these contradictory findings.

Nelson and Cheney developed their own measure of end user ability, and Lee, Kim and Lee used that same measure in their later research. Any results related to this measure of ability should be comparable between the two studies. On the other hand, Nelson and Cheney used a surrogate measure for end user acceptance: the Ives, Olson and Baroudi (1983) questionnaire on user satisfaction. Lee, Kim and Lee used an instrument developed by Davis, Bagozzi and Warshaw (1989) to measure user acceptance. They also included user satisfaction in their model; like Nelson and Cheney, they used the Ives, Olson and Baroudi questionnaire to measure user satisfaction. Nelson and Cheney used the same instrument, but called it by a different name: user acceptance instead of user satisfaction. When conducting the path analysis, Lee, Kim and Lee found no direct path between ability and satisfaction, which actually confirms the results found by Nelson and Cheney. Furthermore, Lee, Kim and Lee found that there were significant paths between ability and IS acceptance and between acceptance and IS satisfaction, indicating that user satisfaction is indirectly related to ability.

Cronan and Douglas (1990) asked supervisors and end users to evaluate the effectiveness of an end user training program; therefore, this article is primarily discussed in the "Evaluation of Training" section. In addition to measuring the effectiveness of the program, though, they also reported that "... a high degree of satisfaction resulted from the EUC [end user computing] program."

Along these same lines, Yaverbaum and Nosek (1992) examined the effects of IS education and training on user satisfaction. They requested MBA students to complete the Ives, Olson and Baroudi (1983) questionnaire on user satisfaction at the beginning and end of a semester during which an introductory MIS course was offered. Satisfaction changed significantly after the students completed the course. The researchers concluded that after the course students were less tolerant of the poor attitudes in the MIS organization, more understanding of the functions and concerns of the MIS organization, and more critical of the systems produced by the MIS organization.

Simon et al. (1996) explored the effect of training method on performance and user satisfaction. The three training methods used by Simon et al. included lecture, exploration (or self-study) and behavior modeling. They found significant differences between the treatments in relation to user satisfaction, with those groups assigned to behavior modeling reporting the highest levels of user satisfaction. The results they found regarding performance are discussed in the next section, Training Methods.

Training Methods

The research that has explored the effectiveness of training methods has examined various methods for presenting the content of the training (lecture, self-study and behavior modeling), as well as examining the content of the training itself (procedural versus conceptual training). Davis and Davis (1990) was the first study to compare training methods. Students in an introductory undergraduate IS course participated in the study by completing three exams and five programming assignments after receiving their assigned treatment. They were divided into two groups; one group listened to lectures, while the other group received self-study materials. The lecture group significantly outperformed the self-study group, indicating that an end user would need fairly unique characteristics to effectively use self-study materials. When the researchers compared the two groups, they found that concepts were retained better by the students who had received the lecture treatment and that procedures were retained better by the students who had completed the self-study materials. Davis and Davis also analyzed several demographic characteristics of the students in their study. Those results are discussed in the next section, "Trainee Characteristics".

Compeau and Higgins (1995) compared the lecture teaching method to behavior modeling using managers and professionals as their subjects. They hypothesized that behavior modeling would increase the subjects' self-efficacy and perceived expected outcomes. Both groups received general computer training in Word Perfect and Lotus 1-2-3. The lecture treatment group received a standard lecture presentation, while the behavior modeling treatment group watched a videotape in which an actor portrayed using the two software programs. The script for the videotape was designed to show the actor experiencing difficulty with the computer at first, but then gradually achieving some degree of mastery over the two programs. The subjects were given performance tests at the end of the experiment.

Somewhat contrary to the researchers' hypotheses, those subjects exposed to behavior modeling outperformed the other subjects only with Lotus. There was no significant difference between the groups' performance on Word Perfect. The researchers proposed that their subjects may have had a stronger conceptual foundation for word processing tasks than for spreadsheet tasks, so behavior modeling provided a more effective method for learning more difficult tasks. Also contrary to the researchers' hypotheses was a negative relationship between outcome expectations and performance. The researchers proposed that the time frame of the training period was too short (it occurred over two days) for performance to reach the level of outcome expectations. Since the subjects were novices, their expectations may have represented a long-term view of their potential which they had not yet had a chance to achieve.

Simon et al. (1996) compared all three of the training methods: lecture, self-study and behavior modeling with members of an active duty U. S. Naval Construction Battalion serving as subjects. The training covered general computer information and also the use of Micro-SNAP, a DOS-based application used for ordering, tracking and issuing material. Behavior modeling, again, provided superior retention of knowledge and transfer of learning compared to the other two training methods.

Instead of comparing the form of presentation of the training, some studies have compared the content of the training. Olfman and Mandviwalla (1994) and Santhanam and Sein (1994) both compared conceptual and procedural training. Olfman and Mandviwalla (1994) trained university employees on Windows, dividing the subjects into two treatment groups: one receiving conceptual training, and the other receiving procedural training. The researchers found no significant difference in the amount learned between the two groups.

Santhanam and Sein (1994), on the other hand, not only compared the two training methods, they also attempted to measure the mental models formed by their subjects. They recruited undergraduate students in an introductory IS course and trained them on the usage of e-mail. Similar to Olfman and Mandviwalla (1994), they found no significant difference between the two methods, but when they considered whether the subjects formed conceptual or procedural mental models, they found that conceptual training outperforms procedural training if the subject forms a conceptual mental model. Also, subjects were better able to perform on complex tasks if they had formed conceptual mental models. Unfortunately, over a three week time period, those subjects with a conceptual mental model appeared to regress to a procedural mental model.

Davis and Bostrom (1993) examined two variations of self-study materials, exploratory and instructional booklets, and found no significant difference in the performance of the two groups. Their subjects consisted of undergraduate students from an introductory IS course. In addition to comparing the structure of the self-study materials, they also compared the performance of the subjects based on the type of interface used. One group used a direct-manipulation interface (the Macintosh Finder), while the other group used a command-based interface (DOS). They found that subjects trained with the direct-manipulation interface performed better than the other group; however, it seems unlikely that the performance of the two groups could be directly compared. The two interface types are based on extremely different paradigms, and require the users to perform very different tasks. It seems unlikely that the researchers used performance tests for these two interfaces that accounted for some of their fundamental differences.

Computer-assisted instruction (CAI) was examined by Ahrens and Sankar (1993) in an attempt to determine whether it provides a suitable tool for training end users. They developed two different tutors for training users on entity-relationship diagrams. One tutor merely presented the information to the subjects in a passive manner; the other tutor asked questions and then immediately evaluated the answers that were given. The researchers used undergraduate IS students as subjects and assigned them to one of the two tutors. The results indicated that the subjects had better retention of procedural tasks than conceptual material. Also, performance was higher when the tutor asked questions. This seems to provide evidence that CAI tutors may be effective in training users on procedural tasks. They also appear to be more effective than written self-study materials since the subjects using the question-and-answer tutor outperformed those that used a tutor that only presented information (similar to reading a self-study booklet). The ability of CAI to interact with the user and provide immediate feedback seems to increase the user's retention of the material presented by the program.

As opposed to single training sessions, Ngwenyama (1993) proposed a method for continuously increasing end user competence. He called the method Collaborative Action Learning (CAL) and basically proposed that "... the participants collectively engage in a continuous cycle of experiential learning ..." CAL begins with project initiation, then cycles through information requirements definition, application prototyping, system implementation, post development discussion, and then repeats again with information requirements definition. The researcher conducted a case study with an organization that used CAL, and concluded that it allowed for the "... maintenance of an adequate level of end-user competence."

Trainee Characteristics

In addition to the training method used, some researchers have hypothesized that the personal characteristics of the end users may have an impact on the effectiveness of training. For example, Davis and Davis (1990) examined age, formal educational level, human information processing style and gender. The variables with significant differences were age, formal educational level and information processing style. The oldest age group, those from 25 to 39 years old, performed better than younger subjects. This seems to fit anecdotal evidence that students above the traditional ages generally perform best in class. Also, those subjects who had twelve years of education or more than fifteen years of education performed better than those subjects with thirteen to fifteen years of education. This seems to fit the anecdotal evidence, also. The researchers found significant differences with the information processing style variable for those subjects with a thinking style as opposed to a feeling style. This seems to indicate that those end users with a preference for a feeling style of information processing may be somewhat at a disadvantage compared to other end users and may require special consideration in designing training sessions. There were no significant differences in gender.

Bostrom, Olfman and Sein (1990) examined the influence of an end user's learning style on the effectiveness of training. They used Kolb's learning style inventory (1976) to classify their subjects into four learning styles, and then examined the outcomes of four separate experimental studies (two of which used undergraduate students as subjects, one used MBA students as subjects, and the other used employees as subjects) to determine whether individuals with certain learning styles have a preference for training that uses certain conceptual models (abstract or analogical) and certain training methods (applications-based, an exploration-oriented approach focusing on tasks, or construct-based, an instruction-oriented approach focusing on specific features).

The researchers found significant differences between the four learning styles, leading them to recommend certain conceptual models and training methods for certain learning styles. Convergers[1] and assimilators performed best with abstract conceptual models, while divergers and accomodators performed best with analogical conceptual models. Applications-based training worked best with convergers and accomodators, while construct-based training worked best with assimilators and divergers.

Ruble and Stout (1993) criticized the Bostrom, Olfman and Sein article, claiming that the findings were not consistent with the hypothesized interaction between learning style and training method and that the learning style inventory that was used lacks reliability and validity. Ruble and Stout propose that the inconsistent findings may have resulted from the poor psychometric properties of the learning style inventory. Bostrom, Olfman and Sein (1993) countered these arguments by claiming "... that: (1) research on important issues cannot be (and is not, in practice) suspended until highly valid instruments are constructed, and (2) that imperfections in the KLSI-1976 did not significantly affect the operationalization of learning styles in our studies, and, thus, our findings are credible."

Simon, et al. (1996) used the Wonderlic Personnel Test to measure cognitive ability as a covariate in their research study, which examined the relationship between training method, performance and user satisfaction. Cognitive ability was found to be nonsignificant, but there was a slight interaction with some of the tasks. These tasks tended to require more abstract thinking and less procedural knowledge, leading the researchers to conclude that cognitive ability was not predictive of performance on concrete, procedural tasks, but may be useful for abstract, conceptual material.

Mackay and Lamb (1991) examined whether the training needs of end users differed depending on their possession of referent experience and task domain knowledge. They used twelve subjects, six health care marketing analysts and six accountants. These subjects were asked to locate sites for emergency medical clinics using demographic data that had been entered into a Lotus 1-2-3 spreadsheet. Protocol analysis was used to examine the cognitive problem-solving process used by each subject. The subjects were categorized into four groups, based on whether they were a novice or expert regarding referent experience (knowledge of Lotus 1-2-3) and task domain knowledge (health care marketing).

Those subjects who were expert in both referent experience and task domain knowledge solved the problem in a different manner than the other three groups, using a more complicated set of commands to achieve their solution. The other three groups were very similar to each other, leading the researchers to conclude that the content of training sessions may need to be tailored to areas in which the end users are novices.

Need for Training

Nelson (1991) began a stream of research that examined end users' needs for training. To that end, employees in eight different organizations completed a survey measuring the self-perceived need for training among IS and end user personnel. He found that both IS and end user personnel reported that they were deficient in general IS knowledge, that IS personnel were deficient in organizational knowledge, and that end user personnel were deficient in IS-related skills. These results seem to indicate that both groups require further training and that organizations should carefully consider their current training programs to ensure that they meet the needs of both groups.

Nelson continued his work with needs analysis by proposing a framework (Nelson, Whitener and Philcox, 1995) that would provide an effective foundation for an organization's training program. The framework consisted of a grid formed by intersecting three types of training content (personal, task and organizational) and three levels within the organization (individual, subunit and organizational). Each cell in the grid suggests issues that need to be addressed by the organization's training program.

To investigate the effectiveness of this framework, the researchers performed a case study on the Internal Revenue Service (IRS). The IRS had recently adopted a new initiative for training that included a more extensive needs analysis which utilized six of the nine cells in the proposed framework. After interviewing executive management and personnel responsible for end user training, and after examining documentation and archival records, the researchers concluded that the framework improved the needs-assessment process, even though all the cells in the framework had not been used.

Evaluation of Training

Cronan and Douglas (1990) evaluated the effectiveness of a training program at a public agency by requesting that end users and supervisors evaluate the program. The evaluations indicated that the training program had been effective. In addition, empirical measures indicated that the training had resulted in "... [a] 24 percent increase in productivity, a savings of approximately 7.6 hours per week, and a high degree of satisfaction . . . "

Carroll and Rosson (1995) provide a framework for managing training evaluation. They illustrate this framework by reporting a case study on an organization that used this framework. The case study indicated that the framework was effective, and they conclude that "... training evaluation coextends with the analysis, development, and deployment of training systems and requires a lifecycle-oriented management process."

Training Environment

Galletta, et al. (1995) investigated the effects of positive and negative word-of-mouth communication during a training session. MBA students worked through a packet of exercises that provided a series of step-by-step instructions on building a spreadsheet that included text and a graph. The positive and negative word-of-mouth groups had several students that acted as confederates in the experiment by giving positive or negative comments during the course of the training. After completing the training packet, students were given the opportunity to explore the software on their own. They then completed a quiz covering concepts that were taught in the training packet. Also, they completed a questionnaire measuring their attitude toward the software and intent to purchase the software.

The negative word-of-mouth groups scored significantly lower than the positive groups in attitude, intent to purchase or use the software, and performance on the quiz. There was no significant difference in the performance of the positive and negative word-of-mouth groups on the initial training task; however, a majority of students received a perfect score on the completed task, leading to a very low variance. There was also no significant difference in the amount of exploration that occurred in the positive and negative word-of-mouth groups, with nearly half the students spending no time in exploration.

The control group (which had neither positive nor negative outbursts) was nonsignificant with respect to the positive word-of-mouth group in all four of the scores that were measured. This led the researchers to believe that the outbursts in the positive word-of-mouth group had a distracting effect that lowered their scores, even though the positive comments increased the students' scores.

Organization Environment

Fitzgerald and Cater-Steel (1995) conducted a case study on an end user training program that operated within a low-cost budget. The trainees and trainers evaluated the strategy, and the results indicated that the training had produced productivity increases. Recommendations were made by the researchers, based on successful strategies used by this training program, for effectively designing other training programs within similar budgetary constraints.

DISCUSSION

Clearly, the past ten years of end user training research have reported findings important to the continued success of organizational training efforts. Reviewing the results found within each of the proposed research streams will provide educators with valuable suggestions for improving IS education programs and classes, as well as providing researchers with insight into areas still needing research, both within IS education and end user training. Those research streams which have articles that build upon past efforts have generally revealed consisted and replicable results, but there are still further questions remaining to be answered.

It appears, for example, that training does increase user satisfaction (Cronan and Douglas, 1990; Yaverbaum and Nosek, 1992), but only indirectly; user ability, which correlates with amount of training (Nelson and Cheney, 1987), is related to IS acceptance, which in turn is related to user satisfaction (Lee, Kim and Lee, 1995). Training that uses behavior modeling also seems to lead to higher user satisfaction than training designed around lectures or self-study (Simon, et al., 1996).

Regarding training methods, subjects trained with lectures outperform those trained by self-study (Davis and Davis, 1990). On the other hand, subjects trained with behavior modeling outperform those trained by either lectures or self-study (Compeau and Higgins, 1995; Simon, et al., 1996). If a self-study design is used, it appears that computer-assisted instruction (CAI) is the most effective form of self-study because of its ability to ask questions and evaluate the user's answers (Ahrens and Sankar, 1993). CAI was found to be more effective at teaching procedures than it was at teaching concepts, however.

Lectures seem to allow subjects to retain concepts better, while self-study seems better suited to learning procedures (Davis and Davis, 1990; Ahrens and Sankar, 1993). Conceptual training has been shown to be more effective than procedural training, but only if the subjects form conceptual mental models (Santhanam and Sein, 1994). It is still unclear, though, what the processes are that lead a student to form conceptual mental models.

Some researchers have hypothesized that trainee characteristics may have an impact on the effectiveness of training. Davis and Davis (1990) found that age, education and information processing style significantly impacted trainees' performance. The oldest and youngest trainees, and those with the most and least education, outperformed the others. Those trainees with a thinking style of information processing were found to outperform those with a feeling style.

Research indicates that learning style interacts with the training method that is used (Bostrom, Olfman and Sein, 1990), although there is some controversy over these findings. Cognitive ability was found to be only predictive (and even then, only slightly predictive) of performance on abstract, conceptual material (Simon, et al., 1996). There was no differentiation on concrete, procedural tasks. Trainees with varying levels of expertise with referent experience and task domain knowledge use software in differing ways. It may be that training sessions may need to be tailored to cover areas where the trainees are novices (Mackay and Lamb, 1991).

When developing an end user training program, an organization should consider the needs of its trainees. There is evidence that end users need training in IS-related skills (Nelson, 1991), and a framework has been proposed for performing a needs analysis for training (Nelson, Whitener and Philcox, 1995). This framework could also potentially aid IS departments in developing future educational programs. To establish and maintain high training standards throughout the lifecycle of a training program, training evaluations may be needed. A framework has been developed for performing training evaluations (Carroll and Rosson, 1995). Evaluations performed using this framework indicate that training can effectively increase productivity (Cronan & Douglas, 1990).

The research that has examined the context within which training occurs has found that the training context can have a significant impact on that training. Within the training session itself, negative word-of-mouth can have a significant impact on the attitudes of an entire group (Galletta, et al., 1995). Positive word-of-mouth does not seem to have the same amount of influence. Evidence was also indicates that, despite an organizational context of strict budgetary constraints (familiar to many IS educational programs), effective end user training programs can still be developed (Fitzgerald and Cater-Steel, 1995).

LIMITATIONS AND FUTURE DIRECTIONS

At least fifteen other journals that publish MIS research were not included in this paper. A more exhaustive search could examine these other journals, allowing the literature review to be more comprehensive. It does not seem likely, though, that this would substantially change the findings reported in this paper.

There are several areas where future research could be conducted. Research on teaching methods seems to have shown the superiority of behavior modeling over other methods, but it has not been established that it is equally effective with concepts and procedures (Davis and Davis, 1990; Simon, et al., 1996). It appears that a combination of lectures (to teach concepts) and computer-assisted instruction (to teach procedures) may be the most effective combination (Davis and Davis, 1990; Ahrens and Sankar, 1993). Unfortunately, this combination has not been tested.

While research on trainee characteristics has shown that the effectiveness of training methods may depend on characteristics of the trainees, this research has failed to provide practical suggestions for tailoring the training sessions to individual characteristics. Does a combination of all training methods (in an attempt to meet the needs of each of the trainee characteristics) produce more effective training sessions for all trainees or does the act of combining training methods produce interference that reduces the overall effectiveness of the training? Since the formation of conceptual mental models appear to improve the effectiveness of the training (Santhanam and Sein, 1994), what are the processes involved in forming conceptual mental models? Are there any factors that increase the probability of forming conceptual mental models?

Nelson, Whitener and Philcox (1995) and Carroll and Rosson (1995) both propose frameworks for improving training programs. Case studies are reported for both frameworks that appear to indicate that the frameworks are effective, but further research is needed to demonstrate the generalizability of these frameworks. Galletta, et al. (1995) demonstrated that the environment surrounding training sessions can have a significant impact on the effectiveness of those sessions; however, this studied only one factor, peer comments. Are there other factors that could have positive or negative effects on the effectiveness of training sessions? What strategies can be employed to control these factors to improve the effectiveness of training?

Future research is needed to more fully explore end user training. The foundation of training research has been built, and further research could determine how to continue to increase the effectiveness of training. Training and education efforts in all areas could potentially benefit from further research.

CONCLUSIONS

The past decade of research has provided a valuable beginning to a fuller understanding of training end users. This understanding can and should be applied to improving IS education. Models have been proposed that attempt to describe the processes inherent in the training process, and factors have been discovered that increase the effectiveness of training. Continuing this research to more deeply explore the issues of end user training will enable instructors to continue to increase the effectiveness of their training and classroom sessions.

The results generated by this research are applicable to training not only end users, but to all forms of training including IS education. Further research efforts with end user training could potentially benefit from examining other sources of training literature; for example, education and cognitive psychology. The promise of end user training research has not yet been achieved; working toward that goal will provide us with valuable insights and principles.

ENDNOTE

1. Convergers: abstract conceptualizers and active explorers. Assimilators: abstract conceptualizers and reflective observiers. Divergers: concrete conceptualizers and reflective observers. Accomodators: concrete conceptualizers and active explorers.

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MAPPING SYSTEM DEVELOPMENT GOALS AND METHODS TO WEB PAGE PROJECTS

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Web page projects offer both opportunities and limitations as hands-on projects for students in systems development classes. This paper outlines common pedagogical goals for systems analysis and design courses and then maps the advantages and disadvantages of Web projects over more traditional systems development projects. An example advantage is a greater likelihood of project completion by the end of the term, while a potential problem is the lack of fit between Web page design and traditional modeling tools and techniques. The conclusion is that Web page projects can be beneficial when applied to appropriate objectives and courses.

INTRODUCTION

This paper discusses the appropriateness of Web page design and implementation as hands-on projects for systems development courses. Web page development offers opportunities but also risks in supporting the pedagogical goals of these courses.

In many IS curricula, systems analysis, design, and implementation classes are among the key areas of study. In some programs, IS students are required to work in teams on real projects in the community in these courses. The strengths of this approach include experience in the ambiguities of gathering, documenting, and designing a system with real, changing, and sometimes conflicting requirements. A limitation of this approach is that students rarely have time to fully implement a system, including testing, training, documentation, and user acceptance, by the end of a single course.

Using a Web page as a systems project potentially provides students with a greater likelihood of completing the project. Web page development can incorporate much of the methodology used for traditional systems development projects. However, a limitation of Web page projects is that standard modeling tools and techniques, such as data flow diagrams, do not easily fit the requirements of a Web page. This paper outlines the topics and pedagogical objectives commonly found in systems development courses, then examines how well Web projects support these objectives. The authors report on their own experiences in recent courses, then suggest guidelines for making the best use of Web projects in covering particular areas.

SYSTEMS DEVELOPMENT

Courses in systems development commonly include: systems analysis, systems design, database processing, programming, and perhaps a project course in which students take a complete project from beginning to end. At Kennesaw State, additional courses in which development methods can apply include courses in project management and end-user systems. In many IS programs, due to credit hour constraints, opportunities for students to learn everything they need to know about systems development, including project management, may be limited to a single course in systems analysis and design, with perhaps a second course in database processing and management. Thus, Web page projects may offer a better opportunity for students to experience the full system development life cycle (SDLC) within a single term.

Pedagogical Goals

Systems analysis and design represents the essence of the IS major in bringing together both technical and social perspectives and skills (Dewitz, 1996; Gogone, Couger, Davis, Feinstein, Kasper, & Longenecker, 1995). Technical pedagogical goals include understanding the importance of systems methodologies, learning to use various modeling tools and techniques, documenting design specifications, and developing prototypes. Social or behavioral aspects of systems development that students need to learn include interviewing skills, working on teams with other developers and with end-user clients, understanding organizational behavior and context, and written and oral presentation skills.

On the surface, Web page projects offer opportunities for students to experience many of the social aspects of systems development, such as organizational context and written and oral communication skills. Clearly, Web pages also offer students opportunities to develop technical skills in evaluating and using tools for prototyping, designing user interfaces, and implementing pages. However, Web projects, at least for relatively simple cases that students would encounter within a term, do not require significant analysis, design, and implementation of business processes. They do not lend themselves easily to traditional modeling techniques such as data flow diagrams. Thus, a Web project may limit students in their ability to learn and use these tools, in contrast to what they would learn in analyzing and designing a more traditional system.

Table 1 summarizes potential strengths and weaknesses of using Web pages to achieve systems development learning objectives. As shown, some aspects may have both strengths and limitations with respect to Web projects.

TABLE 1

LEARNING OBJECTIVES AND WEB PAGES

Technical Aspects	Strong	Weak	Comment
Project Management		X	Too easy to jump ahead to implementation
Methodologies		X	Standard methods don't apply easily
Prototyping / RAD	X		Quick and easy to develop
Modeling		X	Standard modeling tools don't apply easily
Tool Use	X	X	Tools still rapidly changing, no standard set
Design Specs		X	Not much processing to analyze and specify
Social Aspects	**Strong**	**Weak**	**Comment**
Interviewing	X	X	Little emphasis on understanding business processes
JAD / Teamwork		X	Less need for JAD sessions to clarify requirements
Organizational Behavior	X		Rich opportunities for politics and multiple conflicting views
Documentation	X	X	Web pages are somewhat self documenting
Implementation & Maintenance Planning		X	Opportunity is there but may be neglected
Oral Presentation	X		

RESULTS AND DISCUSSION FROM EXPERIENCES

Recent experiences with using Web projects in several classes involving systems development have supported most, but not all, of what is outlined in Table 1, and have provided some additional insights and issues which need to be addressed.

Advantages. Students are indeed better able to implement their design within the time constraints of the term. Prototypes can be generated and modified quickly and easily. The development team gets needed feedback from the client because of the short turn-around time of the prototype iterations and the ability of the client to view the prototypes from anywhere they have access to the Web. Furthermore, the work can be viewed and assessed by other members in the class, both team-members and other teams, by accessing the Web site. Artistic ability and creativity are important and valued contributions within the development team, along with technical skills.

Teamwork. The widespread accessibility of the Web can greatly facilitate students' ability to work on a team. If students take advantage of the Web to share all their project documentation (schedules, interview notes, models, discussion) and deliverables, then Web projects could increase even more their ability to communicate and coordinate without having to meet face-to-face as frequently.

Organizational Behavior. Web pages often involve multiple stakeholders and constituents with potentially conflicting views of system (Web page) goals and design. This offers students an opportunity for rich, although frequently frustrating, experiences with organizational power, politics, and culture, and with changing system requirements. Student teams must be sure to identify and involve early on ALL the major stakeholders, and must determine who will be making the final decisions.

Disadvantages. Web projects appear to motivate students to jump prematurely to implementation, because Web development is initially easy and fun. What they lose includes numerous important aspects of systems development. They neglect to focus, and re-focus, on system objectives, to develop and use conventional metrics for cost-benefit analysis and ROI, to consider alternative solutions, and to formally document user needs in terms of attributes, behaviors, and values. Manual procedures surrounding the system seem less relevant than in conventional projects and are ignored. The student interest and emphasis is on making the HTML code work, not on analyzing and fulfilling stakeholder requirements.

System Objectives. In Web page-based projects, students often have a difficult time identifying the specific, measurable objectives that these systems must accomplish. This is partly because the clients themselves may be unclear about why they want a Web site. "To have a Web presence," "to increase awareness of the organization that owns the Web site," and "To increase visits to the site" are common but vague and inadequate against which to measure success.

Modeling. Modeling methods for hypertext systems are likely to serve as more appropriate tools for Web page design (e.g., Isakowitz, Stohr, & Balasubramanian, 1995). However, this still reduces the students' opportunities to learn more common and traditional methods such as data flow diagrams and entity-relationship models.

Prototyping. Prototyping is not a methodology. It is a technique best used in the design phase of an end-to-end methodology to confirm user requirements, after preliminary analysis of the system has established appropriate system objectives, system scope and measurements of success. Conventional prototyping strategies recommend that the prototyping activities be clearly delineated from system construction activities, so that the client does not confuse the prototype with the delivered system. Because student teams prototype their Web pages on the same platform with the same tools with which the system will be implemented, the verification of each successive iteration of the prototype gets blurred with the construction activities of the system, often resulting in premature cut-over. These systems will lack adequate testing, documentation, back-up and recovery procedures, maintenance procedures, and other attributes that are a result of conventional implementation and installation procedures.

Object-Oriented Development. Current object-oriented methodologies (Booch, 1996) appear on the surface to be especially appropriate for Web page development. The argument goes: "We are entering the era of object-oriented technologies; web-page development is a new technology; therefore it will be best served through the application of object-oriented system development methodologies" (Dick, 1996). However, tools and methods for OO analysis and design are not yet standardized (Joukhadar, 1997), and existing tools tend to focus less on early phases in the life cycle and more on detailed design and implementation (Carlson, 1997). They fail to guide the developer toward a meaningful analysis of the client's problems, opportunities to be exploited, and constraints to be addressed in the development of the system.

Tools. The degree of access to Web page development tools, clip art, cgi scripts, Java applets, etc., can create an uneven playing field in the evaluation of student Web page projects. Students who have access to a Web page workbench will have a substantial advantage over those who do not. Care must be taken to establish objective team project evaluation that reduces the impact of student team access to commercial construction tools, or, alternatively, all students must be provided with access to a similar toolset. This, however, is difficult in the current environment of rapidly evolving Web-related tools.

Trademarks and Intellectual Property. This is an additional issue that arises with Web pages much more than with traditional systems. Students quickly learn to "right-button" good ideas off of the Web and incorporate them into their projects. Backgrounds, art work, animated "gifs", Java applets, etc. are freely captured and reused. Course policies dealing with intellectual property must be developed and understood by the development teams. Because the student project has the potential to be viewed by any Web user, care should be given to the appropriate disclaimers as well as potential violation of institutional policy, local, state, and federal law.

CONCLUSIONS AND SUGGESTIONS FOR EDUCATORS

In spite of some limitations, the authors believe that Web projects can provide some benefits over traditional projects for students learning about systems development. The authors conclude, however, that Web projects will be more appropriate in courses other than in a systems analysis and design (SAD) class. This is because, as discussed above, some of the most important concepts in systems analysis and design may be de-emphasized, neglected, or difficult to support when developing a Web page. More appropriate courses would include: Introduction to Information Systems, a follow-on course to SAD which focuses on the later stages of the SDLC (design and implementation), project management if separate from SAD, and coursework which focuses on User Interface Design.

However, if a particular curriculum limits systems development coverage to a single term-long course, then Web pages could still be used. Special attention should be paid to emphasizing and producing deliverables that demonstrate understanding of the early stages of SDLC, such as system objectives, feasibility and cost-benefit, and measurement of project success. Some methods and modeling techniques may be adapted to Web projects, such as structure charts and object models, and students should also be required to develop and document implementation and maintenance plans.

Development of Web pages should be distinguished from development of Web page *systems*. Development of systems includes such broader issues as project management, setting and measuring objectives, procedures for security, backup, and maintenance. Web page projects should strive to incorporate this broader perspective. If Web page projects are viewed by students and faculty as systems, then they can be used more effectively to teach and learn systems concepts and skills.

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AN EXAMINATION OF THE CHARACTERISTICS OF STUDENT INTERACTION IN COMPUTER-BASED COMMUNICATION ASSIGNMENTS

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Student interaction and computer-based communication tool appropriation patterns were examined in two different communication assignments requiring active use of computer-based communication tools. University students completed either: (a) a set of communication assignments and activities with the instructor as sole audience; or (b) a set of communication assignments and activities requiring discussion among students as the primary audience. Two cases were used to explore the communication content, the format of communication exchange, and the timing of the communicative interaction. The interactions were coded along several dimensions including social communication, aggressive/destructive communication, and closed versus open ended communication. The results show that the communication content was relatively free of flaming (i.e., destructive communication), the format of the communication exchange closely mirrored the assignments, and a significant (30%) proportion of the communication took place outside of the "normal" 8 to 5 timeframe. These results suggest that instructor worries about excessive flaming are unwarranted. Further, they indicate that instructors must carefully consider the outcome they desire from the technology to be sure the assignments will lead to those outcomes. Finally, the results indicate that students do appropriate the technology at varying times, resulting in an expanded classroom space.

INTRODUCTION

Today's educators face innumerable pressures to provide quality instruction within the market constraints of increasing class sizes, increasing customer demands for flexible course scheduling, and an increasing age profile of students (i.e., more adult learners outside the traditional 18-22 year-old range). Computer-based communication tools (CBCT's) are frequently touted as a low-cost and effective means to this end, especially in the case of distance education programs (Berge & Collins, 1995; Garrison, 1990; Huang, 1996-97; Lyons, 1995; Santoro & Phillips, 1994; Wells, 1992). CBCTs are communication technologies that include electronic mail discussion groups, conferences and/or chat rooms, and dynamic material repositories such as web pages and shared databases (Harasim, 1990; Hiltz, 1994; Rice & Associates, 1984; Santoro, 1994, 1995; Sproull & Kiesler, 1992). A central feature of these tools is the support of communication tasks -- specifically the enabling of person-to-person (or person-to-many persons) interaction across space and time constraints such as those normally imposed by a physical classroom (Harasim, Hiltz, Teles, Turoff, 1995; Hiltz, 1994). Although researchers and educators have investigated the utility of these approaches as instructional delivery mechanisms (Berge & Collins, 1995; Hiltz, 1986, 1990; Huang, 1996-97; Wells, 1992), the examination of student interaction patterns during CBCT usage for pedagogical purposes (such as active learning) is a relatively new empirical topic.

CBCTs provide opportunities for instructors to expose students to knowledge, as well as opportunities for students to build their own knowledge through interaction via an electronic communications medium (Corporation for Public Broadcasting, 1994; Garrison, 1990; Harasim et al., 1995; Hiltz, 1994; Price, 1996; Salomon, 1991). The exposure to and development of student knowledge transpires as a function of the dynamic interaction process within the learning environment (Angelo, 1993; Cross, 1987; Johnson & Johnson, 1994; Wang, Haertel, Walberg, 1993). Thus, usage of CBCTs may promote active learning of course material by engaging the student in communication activities and behaviors that stress interaction among students and between the student and the instructor(s). However, students must individually appropriate and use the CBCT in a manner that supports effective interaction in order to gain such benefits (Collins, 1996-97; Harasim, 1993; Hiltz, 1994; Kaye, 1992; McComb, 1994; Santoro & Phillips, 1994; Vician & Nickles, in press). Factors that can significantly influence the effectiveness of student interaction include the communication message **content,** the communication exchange **format,** and the communication exchange **timing** (Bormann, 1989; Daly, Friedrich, and Vangelisti, 1990; Lowry, Koneman, Osman-Jouchoux, & Wilson, 1994; Phillips & Santoro, 1989; Santoro & Phillips, 1994; Shedletsky, 1993).

Examining the characteristics of student interaction within CBCT usage is key to forming an understanding of CBCT appropriation patterns, and ultimately discovering factors that may influence student learning outcomes. To examine the characteristics of student interaction and CBCT appropriation behaviors involved in completing computer-based communication assignments, we employ a case study methodology. Specifically, we focus on three key dimensions: (1) the communication content, (2) the communication exchange format (i.e., the extent to which threaded discussions are conducted versus more question-and-answer dialogues), and (3) the communication exchange timing (e.g., the degree to which students use the technology to extend the boundaries of the classroom by using the CBCT beyond "normal" hours). This study is a descriptive inquiry within our larger quest to understand the potential influence of CBCTs in student learning experiences. Our research efforts are focused on the following overall question: What kinds of student interaction and CBCT appropriation patterns occur when students are asked to complete computer-based communication assignments?

The remainder of this paper is organized as follows. We first present our research framework, followed by a description of our methodology, and our analytic approach for this study. We then present the results, followed by a discussion of the theoretical and practical implications of differences in student interaction and CBCT appropriation patterns. The paper concludes with suggestions for future research.

RESEARCH FRAMEWORK

Our research framework is grounded in communication theories of interpersonal and small group interaction (Bormann, 1989, 1990; Brammer, 1993; Daly et al., 1990), research on computer-mediated communication and electronic mail (Culnan & Markus, 1987; Garton & Wellman, 1995; Markus, 1994a, 1994b; Rice & Associates, 1984; Sproull & Kiesler, 1992; Walther, 1996), educational theories of learning and instructional design (Angelo, 1993; Astin, 1993; Cross, 1987; Gagnae & Briggs, 1974; Johnson & Johnson, 1994; Martin & Briggs, 1986; Sadker & Sadker, 1992; Salomon, 1991; Wang et al., 1993) and research on cyberspace, distance, online, and virtual learning environments (Harasim, 1990; Hiltz, 1994; Hiltz & Turoff, 1993; Kaye, 1992; McComb, 1994; Phillips & Santoro, 1989; Santoro, 1995; Wells, 1992). Figure 1 presents our overall framework resulting from a synthesis of prior research and theory; Figure 2 provides a specific model of the variables of interest in this study. The remainder of this section will describe the relevant components of Figure 2.

FIGURE 1

RESEARCH FRAMEWORK

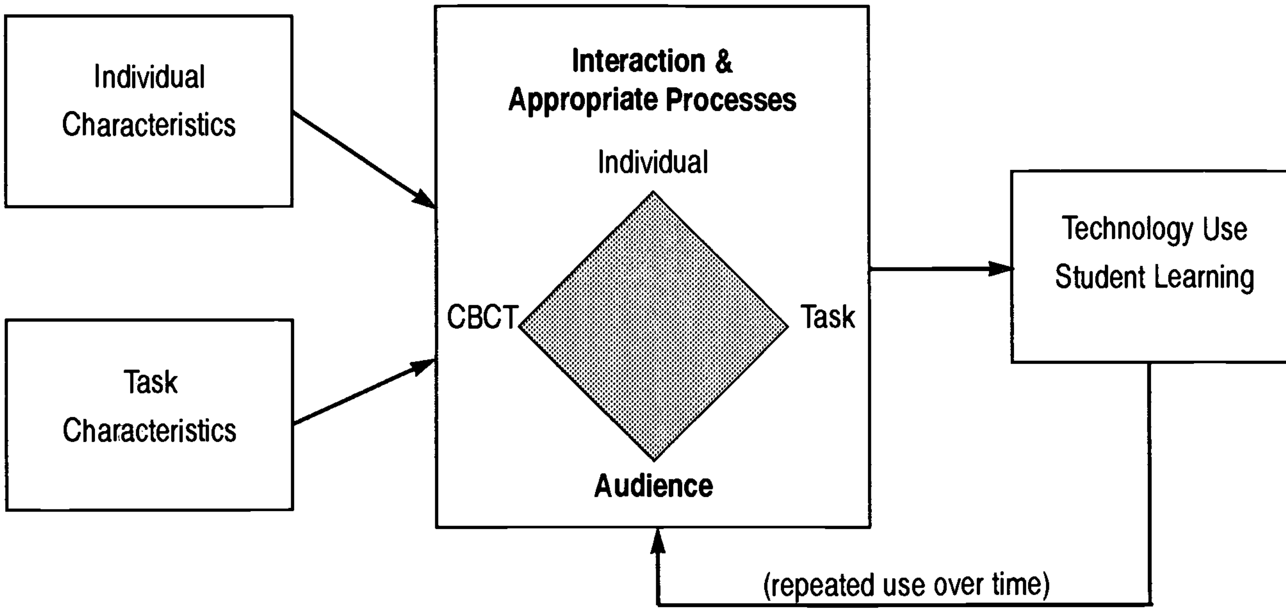
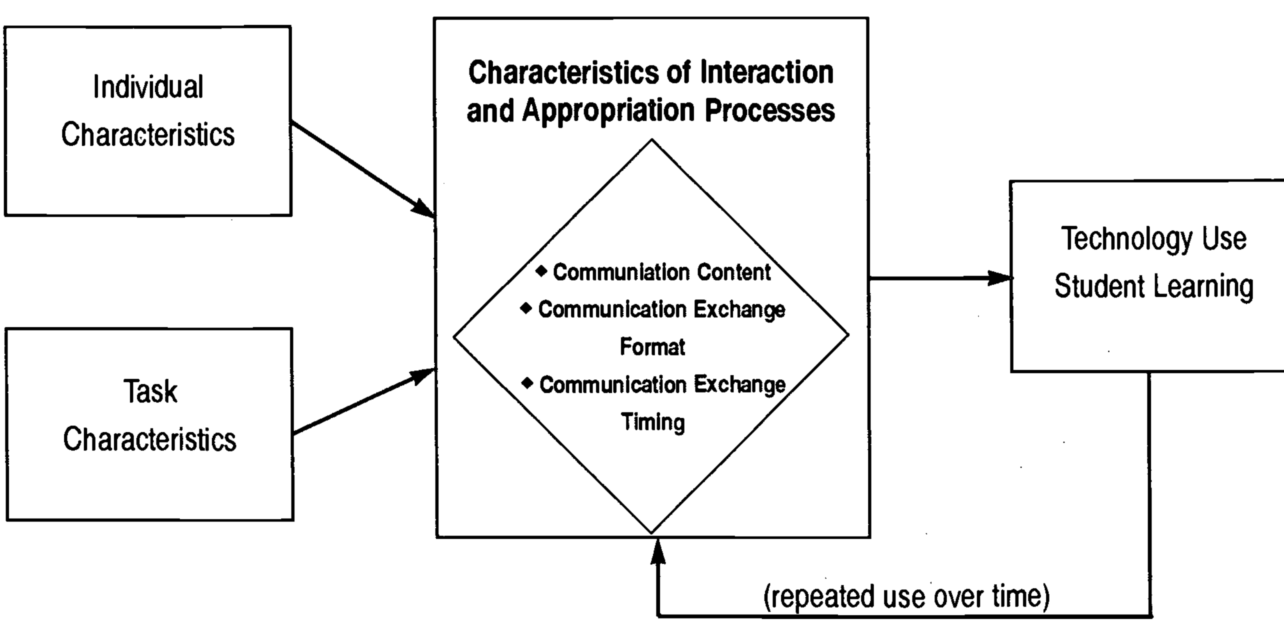


FIGURE 2

SPECIFIC RESEARCH MODEL APPLIED TO STUDENT INTERACTION AND APPROPRIATION PROCESSES



Communication Content

In a classroom setting, the communication content can be influenced directly and immediately by the dynamic discussion of other communication partners who are also present at the same-time and same-place. In addition, the presence of the instructor is likely to have an influence on the content and tone of the classroom communication. In a computer-based environment, however, the influence of other individuals can be less obvious and less immediate (Finholt & Sproull, 1990; Garton & Wellman, 1995; Markus, 1994b; Sproull & Kiesler, 1986). Some instructors worry that students might engage in inappropriate behavior, such as flaming (Kiesler, Siegel, and McGuire, 1984; Sproull & Kiesler, 1986). This could make the computer-based environment uncomfortable for some students, and actually lead them to avoid using the system. On the other hand, students might engage in more personal exchanges of information (Vavarek and Saunders, 1993-1994; Walther, 1996) that could facilitate relationship building with the instructor or other students (Johnson, 1981; Johnson & Johnson, 1994; Wang et al., 1993), and could lead to a more positive perspective of the educational experience (Collins, 1996-97; Harasim, 1993; Hiltz, 1994; Martin & Briggs, 1986; McComb, 1994).

Communication Exchange Format

Classroom interaction can take a variety of forms, such as question-and-answer or extended discussion. This is also true of computer-based interaction. But, the extent to which either interaction pattern is prevalent depends on how the students appropriate the technology (Hiltz, 1986; Hiltz, 1990; Levin, Kim, & Riel, 1990; Markus, 1994b; Philips and Santoro, 1989). Even in situations where the goal is to have a discussion, student interaction may take the form of a question and answer format. On the other hand, students might use the technology to obtain feedback or engage in problem-solving behavior, and thus extend their use of the technology beyond the task demands (or implicit instructors' goals).

The format of the communication exchange also has significant bearing on the depth of social interaction possible for individuals in the communication exchange (Bormann, 1989; Daly et al., 1990). Educational research argues that social interaction is integral to the development and refinement of knowledge, especially for adult learners (Johnson & Johnson, 1994; Martin & Briggs, 1986). Further, social interaction is central to the facilitation of collaborative and active learning activities (Angelo, 1993; Brufee, 1984; Cross, 1987; Pence, 1996-97). CBCTs have been found useful in supporting the social interaction of learning processes in the college classroom (Harasim et al., 1995; Hiltz, 1994; Hiltz & Turoff, 1993). However, it is important to examine the actual communication exchange format that results after student appropriation of the CBCT in order to assess the depth of interaction achieved by the students.

Communication Exchange Timing

Classrooms are constrained by time and space. With the current trend toward increased class sizes (Weimer, 1987), per-student air time has decreased substantially. CBCTs, and especially electronic mail, can transcend the space and time constraints of the physical classroom by providing students with seven-day-a-week, 24-hour access to communication exchange opportunities. The asynchronous nature of electronic mail, in particular, allows an individual substantial control over when messages are sent or received. Use of a CBCT in support of class objectives provides maximum scheduling flexibility in an individual's work-day and can change the nature of per-student air time in the class. Thus, the use of CBCTs can augment classroom air time, both in terms of quantity and in terms of student availability.

Additionally, educational research suggests that student-student interaction and student-instructor interaction are critical to student satisfaction with and success in the education process (Astin, 1993; Johnson, 1981). Hiltz (1994) provides self-report data indicating that increased access to the instructor was a highly rated attribute of using a specialized CBCT in college courses. CBCTs can provide additional opportunities for such interaction, especially if students use the tools at times beyond the boundaries of scheduled class meeting times. It is important to examine the timing dimension of interaction to gain a better understanding of how students actually exercise their communication timing opportunities.

METHODOLOGY

Overview

Computer-based communication was monitored over the course of a ten-week quarter, in two courses offered to different student populations at a large midwestern university. The courses were selected based on the following criteria: (1) students were required to use the technology to complete course assignments; (2) there was some variation in the assignments across the courses (but not within the courses); and (3) the technology was a pedagogical resource, rather than the object of instruction. Thus, this study employs both literal and theoretical replication (Yin, 1989); we expect similar results along some dimensions (e.g., timing) and different results along others (e.g., exchange format, content).

Subjects

A total of forty-eight undergraduate students (20 in the first course and 28 in the second course) enrolled in two communication courses in different colleges at the same large midwestern university participated in this study. The courses were taught during the same academic year covering a 10-week term. Students participating in the study received course credit toward their final grade.

Task

In course #1 (C1), students were required to submit answers to essay questions directly to the instructor. The submissions had to be sent via the university's electronic mail system (Pine Mailer). In course #2 (C2), students were assigned to conversation groups and required to discuss questions posed by the instructor, also using the university's electronic mail system. Students in C2 sent messages to their group using a distribution list. The instructor was included as a member of the distribution list, but did not participate in the discussion.

Procedures

The instructors of both classes provided a basic introduction to the computer-based communication assignments for each course at the beginning of the academic term and indicated that the instructor could be contacted if students encountered problems with using the CBCT. Further, the instructor for C2 provided an initial electronic mail training session in a university lab as less than twenty percent of the course members had previous electronic mail experience. Additionally, both instructors collected electronic mail messages sent to their mailboxes throughout the quarter.

Measures

Similar to coding techniques used by Poole (1983) and Poole, Holmes, Watson, and DeSanctis (1993), an interaction coding scheme was derived from prior research and used to analyze the content of electronic mail messages. In essence, the coding scheme was designed to assess the characteristics of interest: communication content, communication exchange format, and communication exchange timing.

Each message was separated into turns and coded using the coding scheme developed for this study (see Table 1). A turn represents a distinct topic within a message. Thus, a message can contain one or more turns. There were 207 turns for C1 and 158 turns for C2.

DATA ANALYSIS AND DISCUSSION

The communication messages were printed in hard-copy format and coded according to the method defined above. Two individuals, not the course instructors, coded the data set. A subset of the messages was used to train and co-orient the coders. Following training, these messages were returned to the total data set. Both coders coded all messages and came to consensus on interpretation. Preconsensus agreement of the coders on C1 was 93% and on C2 was 95%. All disagreements were resolved, with coder 1 changing to coder 2's interpretation 42% of the time for C1 and 44% of the time for C2. Coder 2 changed to coder 1's interpretation 58% of the time for C1 and 56% of the time for C2. Coefficients of inter-rater reliability were not calculated for this study due to its exploratory nature.

A total of 214 messages were collected for C1; 160 messages were collected for C2. Some messages were duplications, for example if a student thought a message did not get through, he or she might send it two or three times, just in case. This resulted in a total of 324 valid messages. Descriptive statistics for the dataset are provided in Table 2.

TABLE 1

CODING SCHEME

Construct	Variable	Definition
Communication Exchange timing	Date/Time	Date and Time the message was sent
Communication Exchange format	Topic Continuation	Indicates if this turn continues a topic from a previous message (0=initates; 1=continues a topic begun electronically; 2= continues a topic begun in class).
	Resolution	Indicates if the topic is one that will lead to resolution, such as question and answer format (1) or not, such as questions aimed at eliciting ongoing discussion (2).
Communication Content	Subject type	Indicates if the content of the turn is social (1), housekeeping (2), or relating to substantive course content (3).
	Destructive communication	Indicates if the turn contains characteristics of inappropriate interaction (e.g., flaming) (1) or not (2).
	Private communication	Does the turn indicate that the person desires that this information not be shared? (1=private, 2=not private).
	Sharing	Does the turn demonstrate a desire to establish and/or build a personal (vs. professional) relationship as evidenced through self-disclosure? (1=yes, 2=no)

TABLE 2

DESCRIPTIVE STATISTICS

	Case #1 (C1)	Case #2 (C2)
Assignment	Answers to essay questions were submitted directly to the instructor via electronic mail	Students assigned to conversation groups and required to discuss questions posed by the instructor, using the university's electronic mail system.
Role of Instructor	Active (Receiver and Sender)	Passive (Receiver)
Number of Messages	214	160
Number of Valid Messages	194	130
Number of Turns	207	158

Communication Content

The variables of subject type, destructive communication, private communication, and sharing were used to assess communication content (see Table 3). Substantive course content was the focus of the majority of turns in both courses. Surprisingly, only 6% of the communication incidents were regarding social topics. However, there is evidence that use of the computer-based communication tool did not impede student self-disclosure activities (sharing) as 32% of the turns in C2 and 16% of the turns in C1 evidenced such communication content. This suggests that the computer-based medium is not seen **primarily** as an arena to build relationships among students or between student and instructor, though our evidence demonstrates a noticeable level of sharing does occur.

With regard to destructive communication, the majority of communication incidents were found to be free of flaming and other aggressive communication. Where negative comments existed, they were typically aimed at the technology. Thus, this suggests that instructors need not worry about excessive flaming, at least when they are virtually present in the interaction.

Finally, there were very few communication incidents in which the student expressed a desire to keep the content private. As expected, there were more private communications in C1 where the interaction was typically student to instructor, rather than student to students as in C2. This suggests that the potential exists to use CBCTs as a substitution for face-to-face office hours. However, the students may not have realized the ease with which a message can be forwarded (accidentally or purposefully), and thus may not have assumed privacy without requesting it.

TABLE 3

ANALYSIS OF COMMUNICATION CONTENT

	C1 (Questions and Answers)	C2 (Group Discussions)
Subject type:		
course content	135 (65%)	123 (78%)
social	1 (6%)	1 (6%)
course "housekeeping"	60 (29%)	25 (16%)
Destructive	4 (2%)	8 (5%)
Private	32 (15%)	4 (2.5%)
Sharing	34 (16%)	50 (32%)

TABLE 4

ANALYSIS OF COMMUNICATION EXCHANGE FORMAT

	C1 (Questions and Answers)	C2 (Group Discussions)
Resolution		
Move to resolve	193 (93.2%)	37 (23.4%)
Open ended	14 (6.8%)	121 (76.6%)
Topic Contintutation:		
Computer-based	141 (68%)	96 (60%)
Class	39 (19%)	31 (20%)
Initiation of a topic	27 (13%)	31 (20%)

TABLE 5

COMMUNICATION EXCHANGE TIMING ANALYSIS

	C1 (Questions and Answers)	C2 (Group Discussions)
Turns outside "normal" hours	61 (29.5%)	59 (37.3%)

Communication Exchange Format

The variables of topic continuation and resolution were used to assess communication exchange format (see Table 4). Overwhelmingly, the coded communication incidents showed that student interaction mirrored the requirements of the task assignments. In other words, question-and-answer (move to resolve) was the focus in the first class, and extended discussions (open-ended) were the focus in the second class. There were, however, many references to previous computer-based messages, as opposed to class discussions. These results suggest that students view the computer-based communication forum as a distinct and separate discussion arena, one with its own topics and purposes.

Communication Exchange Timing

Finally, the time stamps of messages were used to assess the times during which communication occurred (see Table 5). Our analysis supports the idea that students use the CBCT to communicate beyond the boundaries of a "normal" 8 to 5 day.

Summary

The results suggest that computer-based communication does not have an unusually large incidence of aggressive communication, at least when the instructor is "present." Approximately one-third of the communication incidents were at times beyond the "normal" hours of 8am to 5pm, suggesting that students used the technology to extend the classroom boundaries to times that were appropriate for them. Finally, the results suggest that instructors must be careful to match assignments to goals for using the technology. In other words, simply assigning use of the technology as a class requirement may not meet the goals of increasing student-student and student-instructor interaction.

CONCLUSION

Practical implications

This study provides two major practical insights about student interaction in computer-based communication assignments. First, the frequency and rate of student use of the CBCT can be influenced by instructor responsiveness over the same computer-based communication medium. Instructors need to recognize the importance of taking time to promptly respond to student messages, whether the message content is assignment-specific or not. The actual impact on instructor time/workload depends on the nature of the computer-based communication assignment (Vician & Brown, 1996; Vician & Nickles, in press). However, if the assignment is such that the computer-based communication form replaces the paper form, then the additional time needed is incremental, as in the cases presented here. The key for the instructor of C1 was to respond to messages in a timely manner so that students would continue to appropriate the technology and use it beyond the original computer-based submission. For C2, the use of the CBCT meant that discussions could be tracked more effectively since the instructor retained a copy of all messages. Second, instructors must be careful to match assignments to goals for using the CBCT in a course. If increased interaction is a goal, instructors may need to model technology usage behavior that encourages student to student and/or student to instructor interaction. Further, instructors may need to develop feedback or mid-course intervention methods to adjust interaction levels.

Research implications

This study has several implications for research, many of which are in the form of directions for future research. First, the results suggest the need to match assignments to goals for technology use. This leads us to ask if some combinations are better than others. Further research is needed to determine how the combinations influence student learning. Second, the results suggest that individual and task characteristics might interact to influence interaction, appropriation processes, and student outcomes. This leads us to ask what are the theoretical relationships among individual characteristics, task characteristics, interaction and appropriation processes, and student outcomes (technology use, student learning). Finally, the results raise questions about the extent to which social interaction and relationship building can occur within a learning process dependent upon computer-based communication tools (e.g., distance learning). Educational research suggests that student-student and student-instructor relationships associated with traditional classroom interaction are key to a positive educational experience, and often learning outcomes. Whether or not the student-student and student-instructor relationships will retain primacy in a student's educational experience in the presence of CBCT usage is an empirical question for future investigation.

Summary

This study provides an initial examination of the characteristics of student interaction in a computer-based communication environment, and is part of our larger research stream investigating the influx of computer-based communication technologies into educational settings. This study's results suggest that CBCTs have potential to augment classroom interaction and, perhaps more importantly, to influence student learning experiences and outcomes. Future research is necessary to examine the relationship between student learning outcomes and types of computer-based communication tools, as well as types of computer-based communication assignments. Additionally, research is necessary to determine the boundaries of effective communication in computer-based environments and the influence of computer-based communication activities on a student's general level of communication skills. Finally, and perhaps most importantly, more research is necessary to identify the key aspects of a theory of computer-based communication and student learning.

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WORKSHOP

"Thin Client" Enterprise Information Systems Development Using Microsoft InterDev with SQL Server: Concepts and Systems Architecture, Database Development, HTML and ASP, and System Generation

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WORKSHOP GOALS

The purpose of the workshop is to familiarize participants with "thin client" browser/server hardware and software components, and with systems development strategy.

ISSUES

Client/server designs have utilized smart clients which carry out major components of the IS application. The server typically provides query output in response to SQL commands.

Internet browsers have the capacity to receive HTML which may have embedded all of the screen objects necessary to implement and information system. Active server page concepts involve server based expansion of the equivalent of macros which may access the database to provide components of list boxes, or to record new data values. The expanded results are composed in HTML which is forwarded to the browser for display and input. Browser-provided input is posted to server-based application components which can update or create records in the database.

AGENDA

1. Several sample application designs will be presented. Database development in Access and migration to a SQL Server enterprise database will be demonstrated. Addition of audit controls for record additions and field changes will be demonstrated using triggers and stored SQL procedures.

2. HTML structure and embedded screen objects will be shown. Browser screen objects will be discussed. Use of VB Script to generate HTML from server based ASP applications will be shown to establish a "proof of concept".

3. Enterprise design of Application Screens will be demonstrated using InterDev. Multitable browse, create, and update operations will be discussed.

4. Several enterprise systems based on InterDev will be demonstrated.

BONUS

For those who (1) sign up for and attend the workshop, and (2) agree to write a several page description of their use of the software in the IS classroom particularly involving IS '97 related courses we will request that Microsoft donate free of charge to each participant the following software:

Visual Studio (contains InterDev, VB, Visual C++, Visual J+), Frontpage 97, NT Workstation 4.0, SQL Server 6.5, Office 97.

WORKSHOP

DEVELOPING MULTIMEDIA FOR USE IN EDUCATIONAL SETTINGS

Larry D. Smith
Expert Company

former director of Academic Computing
College of Business Administration
Georgia Southern University

author and consultant

WORKSHOP GOALS

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Internet browsers have the capacity to receive HTML which may have embedded all of the screen objects necessary to implement and information system. Active server page concepts involve server based expansion of the equivalent of macros which may access the database to provide components of list boxes, or to record new data values. The expanded results are composed in HTML which is forwarded to the browser for display and input. Browser-provided input is posted to server-based application components which can update or create records in the database.

AGENDA

1. Several sample application designs will be Workshop Abstract: Multimedia promises to provide a vehicle with impact to the educational setting through the use of visual and auditory stimulation. A wide array of so-called multimedia tools are available at a cost beyond the budgets of many institutions and faculty members. There are some relatively inexpensive tools available to faculty to construct materials utilizing the multimedia capabilities of the personal computer. These products are available at educational discounts; in fact, your institution may already have licenses or may be eligible for education grants covering the cost of the software tool. This workshop will focus on the use of these tools beginning at the most fundamental level and moving to some sophisticated applications. Techniques will be demonstrated, hand-outs with complete seminar notes, and source code will be distributed to enable you to go back to your institution equipped to develop your own materials for your courses situation. The novice programmer as well as the experienced system builder will find unique information here focusing on the college/university classroom environment.

Workshop Format: The program will be conducted in an informal, interactive style. Time will purposefully be taken to answer questions, demonstrate the techniques mentioned, explain the operation of the software in laymen's terms, and provide code for you to try on your own system. If you have a laptop with Microsoft Windows95, Microsoft Office, and/or Microsoft Visual Basic, bring it along; a limited number of machines will be provided for you to practice with during the session.

WORKSHOP OUTLINE:

I. Preliminary material
II. Introduction to multimedia concepts
III. Pedagogical principles related to multimedia
IV. Demonstration of techniques
V. Materials needed to develop multimedia courseware

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