TEACHING RESEARCH METHODOLOGY FOR INFORMATION TECHNOLOGY

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ABSTRACT

The paper reports on an approach to teaching an Information Technology Research Methodology course in a doctoral program, the Doctorate of Management in Information Technology. In this program dissertation research comprises a significant part of the degree following coursework in the domain of information technology. The paper was motivated by the desire to share the experience of the teaching team about the pedagogy and assess how appropriate the approach is in preparing experienced information technology (IT) professionals for their doctoral research projects. The rationale of the course, as well as the educational goal and objectives are presented. A research process model applicable to applied research in IT is proposed and explained. This model accommodates scientific approaches of research using empirical strategies, positivist and phenomenological approaches, and supporting methods, including quantitative, qualitative, and case studies. The course design and pedagogical approach are described in terms of thematic areas of scholarship and practice, and intended outcomes. The anticipated insights and contributions in each of the phases of the research project are addressed. The course covers the topics of

the syllabus, as well as proposal formulation, research design, methods of investigation, methods of demonstrating concept, approaches to research validation, and documenting of research results. A summary of the contributions, lessons learnt, and some conclusions are provided based on the outcome of three offerings of the course.

Keywords: Research methodology, information technology, research process model, pedagogy

I. INTRODUCTION

Many authors have described their approaches to planning, conducting and documenting research, and have stressed the importance of logical flow of presentation, sound language use and editorial finish of technical articles and dissertations [Davis et al, 1997; Dunleavy, 2003; Anson et al., 2003]. Conducting research in the domain of Information Technology (IT) poses special challenges, especially when that research is conducted by practitioner-scholars [Wilson, 2005].

The continuing changes in IT provide new opportunities to professionals in what has been called the E-era of innovation [Butler, 1999]. Enterprises are increasingly dependent on IT systems to provide timely information needed at all levels to facilitate decision-making, services and operations. Most successful enterprises today support their value chains with IT-based systems that implement solutions for one or more business processes, with the ultimate goal to obtain maximum competitive advantage [Willcocks et al., 1997; Harmon, 2002]. At the same time enterprises apportion high importance to the validation of value added by these system implementations and business process improvements. There is a keen awareness of the need to generalize lessons learned, and adopt standards and best practices to improve the probability that future investments in similar projects will yield their expected returns.

Many research projects in the field of IT are being conducted by IT vendors, services organizations, large organizations with research and development units, technology and market research organizations, higher education, and the military. The IT research domain is very broad since it includes the IT systems; the IT people (i.e. managerial and technical); managerial and technical IT processes in the enterprise's value chain; and policies and procedures constraining the IT systems. IT research conducted in graduate study programs at universities are frequently multi-disciplinary, with collaborative projects carried out in colleges of technology, management, business, information sciences, engineering, and other disciplines.

As IT has become central to the contemporary enterprise, research methods for IT research have been actively explored [Weber, 1987; Nunamaker et al., 1991; Davis, 1992; Brinkkemper and Falkenberg, 1991; Hevner et al., 2004]. While some IT research projects are theoretical in nature, most are empirical focusing on the application of theoretical concepts to problems situated in practice, whether within an enterprise or an embedded technology in a product. The keyword classification scheme developed by Barki et al. [1988] for IS research literature includes IT as one of the primary categories.

IT researchers have a range of methods to choose from when planning their research projects. Most of these methods were originally derived from research in non-IT fields, such as the physical, economic, and social sciences. Nunamaker et al. [1991] have classified research into five categories: 1) Basic and applied research; 2) Scientific and engineering research; 3) Evaluative and developmental research; 4) Research and development; 5) Formulative and verificational research. Remenyi et al. [1998] described an approach to empirical research which addresses some of the issues concerning a positivist strategy to research in the field of business and management for masters and doctoral degrees. As the IT field matures, several other research classifications are emerging concurrently. Benbasat [1984], Scott Morton [1984], Galliers and Land

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[1987], Remenyi [1990], and Galliers [1992] have reported on research paradigms for performing IT research. Many authors have remarked on the growing interest in empirical research in IT, including Benbasat [1984], March and Smith [1995], Shull et al. (2001), Kitchenham et al. [2002], Choudrie and Dwivedi [2005], and have proposed research approaches, paradigms and methods for future researchers to follow. It is clearly important that an appropriate research strategy is adopted to address a chosen IT research problem, and in many cases a mixed methods approach yields the best results.

This paper reports on an approach followed to teach IT research methodology within a doctoral program, the Doctor of Management in Information Technology (DMIT). The paper was motivated by the desire to review and assess the appropriateness of the approach in the DMIT to prepare experienced IT professionals for their doctoral research projects. Section I highlights the importance of addressing the challenges of teaching IT research methods. Section II presents the rationale of the course, continuing with a review of the approach followed in the dissertation research phase of the program in Section III. Section IV discusses the context of IT research and reviews some applied research methods, and Section V describes the design and pedagogy of the Information Technology Research Methodology course. A summary of the contribution and some conclusions, based on lessons learnt after offering the course three times, is provided in Section VI.

II. RATIONALE OF THE IT RESEARCH METHODOLOGY COURSE

The body of knowledge represented in the field of IT is evolving continuously as new research ideas are transferred into business and industrial processes aimed at optimizing the functioning of the enterprise at all levels. The DMIT program is designed for IT professionals with high levels of managerial, technical and analytical expertise, most of who are employed in IT organizational units within the enterprise. The DMIT provides advanced learning experiences focused on

leadership through the integration of IT into business and industrial processes to attain higher levels of efficiency and quality.

The field of IT is viewed as encompassing all the software, hardware, infrastructure, and process resources of an IT system, which has the aim of adding value to the business processes of the organization. Research in the DMIT focuses on developing innovative solutions to real-world problems in accordance with the university motto of "Theory and Practice" [Steenkamp and DeGennaro, 2003], and endorses the editorial statement and policy in ISR [2002] that research in the IT disciplines is intended to "further knowledge that aids in the productive application of IT to human organizations and their management".

The DMIT consists of coursework in the major track, the research methods track, and minor track, followed by the dissertation research. The IT Research Methodology course is offered as part of the research methods track and provides preparation for student's dissertation research.

III. DMIT RESEARCH PROCESS MODEL

The dissertation research project represents the capstone learning experience of the DMIT program, integrating the academic content of the curriculum, prior academic knowledge, as well as work experiences. The practitioner-scholar approach of the DMIT program provides the doctoral student the opportunity to seek out a problem, situated in a real-world environment, with potential for an innovative IT-based solution. This may be an innovation in technology, the application of the technology, or enabling of business processes. Where possible, applied research topics are drawn from problems observed in practice, preferably in the student's place of employment, and research is undertaken in partnership with the sponsoring enterprise under a collaboration agreement. The research project is conducted under guidance of a supervisor, who chairs the student's dissertation committee. A domain expert (and/or key stakeholder) from

the sponsoring organization serves on the dissertation committee, and plays a significant role during the research.

The nature of applied research in the field of IT management (which concerns people, processes, procedures, policies, software hardware and infrastructure) necessitates that a flexible research process model be adopted. This process model should allow iteration among processes and accommodate theoretical and empirical research. It should also facilitate positivist and phenomenological research strategies and management of the research project. With these considerations in mind a research process model was designed for the DMIT, providing a common basis for collaboration of students and faculty during the dissertation research process. It divides dissertation research into five main phases as shown in Figure 1, where each phase is associated with one or more dissertation research "courses". This structure helps the dissertation committee and student gauge progress during the research project. Students may only register for the next dissertation "course" when all members of the dissertation committee support the status of the research project at the end of each term. This is in agreement with the university requirements, where students register for one or more three credit hour dissertation courses per semester. The processes in the research phases are typically carried out sequentially with iteration and feedback loops as insights are gained during the investigation. The insights and the contributions made in each of the research phases are outlined below and summarized in Table 1.

The IT Research Methodology course was designed to provide guidance in each of the phases of the research process model, and is the last research methods track course in the curriculum (see Appendix II).

RESEARCH PLANNING – PROBLEM IDENTIFICATION

Here an analysis of problems in the research domain is performed. The student should display insight into the application domain and knowledge of the

applicable theories when focusing on a particular topic and the problems related to it. The advantage of having a student's employer sponsor the research is that the sponsor would have a vested interest in the research outcome, and participate actively in the dissertation committee.

RESEARCH PLANNING – PROPOSAL DEVELOPMENT

The project starts by formulating a research proposal, which outlines the problem to be investigated, the scope of the project, the research approach to be followed, the method of investigation and estimated project schedule. The proposal also includes a preliminary analysis of the literature, dealing with other approaches to the problem in the domain of discourse. It contains the following elements:

- A statement, which outlines the area of the investigation and the context, including the related theories, called the background theory.
- The focus of the topic to be investigated, and the concepts and/or theory on which it is based, called the focal theory. Here the problems related to the topic are determined and some research questions identified. One or more propositions or hypotheses must be stated that will guide the rest of the investigation. Some key literature references in both the background and focal theories must be provided in support of this section of the proposal.
- The research strategy, research design and method of investigation to be followed, such as an empirical strategy using positivist and /or phenomenological methods. Decisions about the collection of evidence, such as qualitative or quantitative techniques are largely refined after the literature review and conceptualization of the solution.
- A draft of sections with proposed titles in the dissertation that will document the outcome of the investigation.

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- The schedule according to which the investigation will be conducted. The schedule is determined in collaboration with the dissertation supervisor and dissertation committee.

RESEARCH - LITERATURE REVIEW

Here the analytical abilities of the student are applied to analyze and interpret the work of others regarding the problem and the stated research questions. During this process a synthesis of ideas, practices and own insight should result that form the basis for conceptualizing a solution to the research questions under consideration. Often there is a certain amount of iteration in refining research questions and the direction of the research as the researcher becomes increasingly more informed about the issues under study.

RESEARCH - CONCEPTUALIZATION OF SOLUTION

During this phase the researcher formulates a theoretical conjecture representing a conceptual solution to the research question(s). The conceptualization varies in form and representation, and may be a graphic model of an empirical generalization, or a mathematical formula representing the insight of the researcher of a potential way to solve the research problem. It may also involve developing a grounded theory, meaning adopting an inductive theory discovery method that allows the researcher to develop a theoretical description of the general features of a topic while at the same time "grounding" the description in empirical observations or evidence. The key variables, and their relationships and dependencies on each other, are determined and expressed in terms of a model. This represents the insight of the researcher about a potential solution to the problem under investigation.

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RESEARCH – EXPERIMENTATION

In this phase the design of the rest of the research project is finalized to enable the conceptual model to be demonstrated, and the proposition(s) or hypothesis (es) validated. Research methods and techniques are discussed in Section IV. Typical methods to demonstrate concept include the

- Design and development of prototypes;

- Design and execution of simulations;

- Design and development of a virtualization solution;

- Gathering of data and development of case studies;

- Design of a survey, its execution, data analysis, statistical processing and interpretation;

- Evaluation of findings in terms of criteria and draw conclusions;

- Validation of research outcomes in terms of research questions, hypothesis(es) or proposition(s);

- Final writing and production of the dissertation;

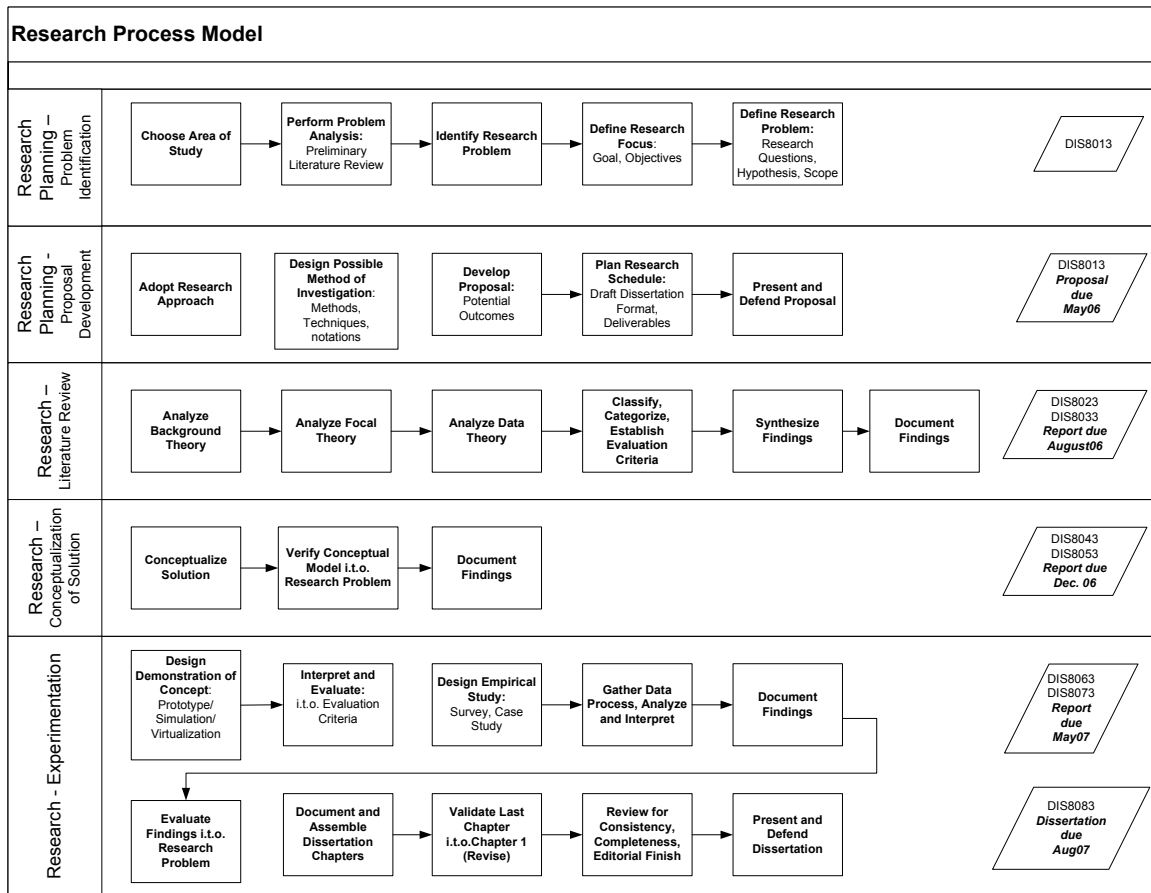- Arrangements of submission for review and dissertation defense.

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Research Process Model

Phase	Activities	Deliverables
Research Planning – Problem Identification	Choose Area of Study → Perform Problem Analysis: Preliminary Literature Review → Identify Research Problem → Define Research Focus: Goal, Objectives → Define Research Problem: Research Questions, Hypothesis, Scope	DIS8013
Research Planning - Proposal Development	Adopt Research Approach → Design Possible Method of Investigation: Methods, Techniques, notations → Develop Proposal: Potential Outcomes → Plan Research Schedule: Draft Dissertation Format, Deliverables → Present and Defend Proposal	DIS8013 *Proposal due May06*
Research – Literature Review	Analyze Background Theory → Analyze Focal Theory → Analyze Data Theory → Classify, Categorize, Establish Evaluation Criteria → Synthesize Findings → Document Findings	DIS8023 DIS8033 *Report due August06*
Research – Conceptualization of Solution	Conceptualize Solution → Verify Conceptual Model i.t.o. Research Problem → Document Findings	DIS8043 DIS8053 *Report due Dec. 06*
Research - Experimentation	Design Demonstration of Concept: Prototype/ Simulation/ Virtualization → Interpret and Evaluate: i.t.o. Evaluation Criteria → Design Empirical Study: Survey, Case Study → Gather Data Process, Analyze and Interpret → Document Findings	DIS8063 DIS8073 *Report due May07*
Research - Experimentation	Evaluate Findings i.t.o. Research Problem → Document and Assemble Dissertation Chapters → Validate Last Chapter i.t.o. Chapter 1 (Revise) → Review for Consistency, Completeness, Editorial Finish → Present and Defend Dissertation	DIS8083 *Dissertation due Aug07*

Figure 1. Research Process Model for Doctoral Research

Throughout the research project outcomes and deliverables are documented in the form of progress reports, draft chapters of the dissertation, and material suitable for one or more scholarly articles. In the case of doctoral research the final deliverable is the dissertation, which is examined by the dissertation committee and is the basis for recommending a candidate for promotion to doctoral graduate status. There are three main milestones in the doctoral research project, namely the proposal defense, the dissertation defense and the graduation ceremony which brings the doctoral studies to a close. Students keep in close touch with their supervisors throughout the research project and have regularly scheduled meetings. The modus operandi of the method of

investigation is determined by the supervisor. At a minimum all scheduled meetings should have an agenda, and outcomes and decisions should be documented in minutes of meetings.

Contributions made during the doctoral research project fall in a number of categories and occur as the research processes unfold during the dissertation research phase of the doctoral curriculum. Table 1 summarizes the insights gained and a number of potential research contributions in terms of the research process model introduced in Figure 1.

Table 1. Insights and Contributions in a Doctoral Research Project

Research Process	Insight	Contribution
Research Planning – Problem Identification	Focus of research problem to be investigated	Formulation of research problem Research questions Propositions Hypotheses
Research Planning – Proposal Development	Scope of investigation Context and focus Research strategy Method of investigation	Rationale (why?, what?, how? relevance of research)
Research – Literature Review	Determination of the current state of theory and application	Analysis of focal theory, application, and supporting technology
Research – Conceptualization of Solution	Concept discovery Theoretical conjecture (displaying creativity in solving the research problem) Potential for empirical generalization	Development of grounded theory Empirical generalization A conceptual model in terms of variables (research constructs) giving nature of their relationships Alignment with research questions, propositions, hypotheses
Research – Experimentation	Designing the approach and finalizing the methods/techniques to be adopted to demonstrate	Confirmation of theoretical conjecture, propositions, hypotheses

	conceptual solution	
	Establish validation criteria	
	Answering research questions	
	Validating propositions, hypotheses	

IV. APPLIED RESEARCH IN IT

The IT research domain may be viewed in terms of the elements in Figure 2, where the IT system is situated within a business or physical domain. An IT system is created by technical developers following accepted IT life cycle processes, adopting frameworks, reference models and methodologies, supported by the use of automated tools. The IT system consists of an IT architecture and supports the business processes of the enterprise, that are improved through the use of IS applications. The diagram also shows the users of an IT system as knowledge workers. Research on IT systems and processes draws on research methods used in several main disciplines, including systems theory, computer science, design science, engineering, cybernetics, and information systems.

INFORMATION TECHNOLOGY MANAGEMENT

IT Management, within the context outlined in Section II, is depicted in Figure 3 as an organizational function, performed by IT people, utilizing IT resources by means of IT processes in support of the business processes of a contemporary technology-enhanced enterprise.
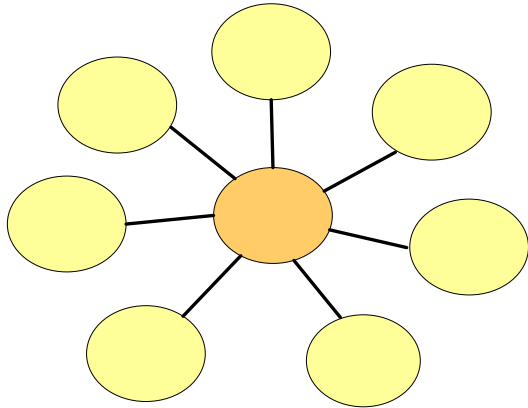
Figure 2.The Context of an IT System
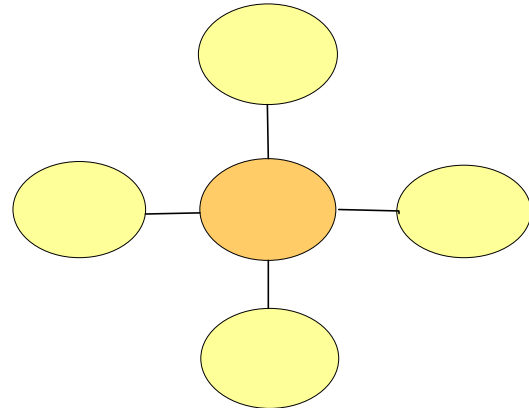
Figure 3. Context of IT Management

In addition to the research methods used in researching IT systems, research on the management of IT is also informed by disciplines in the behavioral sciences, including management, sociology, and psychology in recognition of the people who participate in IT system development, deployment use and control.

TAXONOMY OF IT RESEARCH METHODOLOGIES

The IT Research Methodology course introduces students to seven broad categories of research approaches summarized in Table 2. Examples in each of these categories aid students to examine the nature of their own research problems, and determine the applicability of the methods to their research project.

Table 2. Taxonomy of IT Research Approaches

Approach	Nature	Applicability
Empirical	Based on usable evidence derived from experimentation, observation, or actual data rather than conjecture.	Appropriate for research in IT Management where people, behaviors, processes and IT resources form part of the domain.
Positivist	An empirical study which is based on observation of observable reality, and interventions using several methods.	Appropriate for research in IT, business and management where phenomena, behaviors, processes and inanimate objects form part of the domain.
Non-Positivist	Derives from phenomenology where	Appropriate when the context

(phenomenological)	human behaviors and organizations are studied from individual perspectives.	within which research is performed has social or cultural significance for the research problem.
Quantitative	Relies on the collection of quantitative data resulting from formal controlled experiments to be used as evidence.	Appropriate to replicate or build upon existing quantitative research, or to test candidate independent and dependent variables identified from qualitative studies; Used to analyze collected data using quantitative techniques and interpret the analyses.
Qualitative	Relies on the collection of qualitative data from surveys, observation, and inference.	Appropriate to define the general behaviors of systems or people, and to validate candidate independent and dependent variables.
Case study	An empirical study which relies on observations made during or following a real-world project.	Appropriate to discover potential behaviors of systems or people, and to identify candidate independent and dependent variables.
Mixed	Uses a pluralistic approach and relies on several methods.	Appropriate for situations where some phenomena are well understood while others are less understood. Enables researcher to support/disagree or confirm/refute hypothesis or proposition

Many IT research projects are performed today using an empirical strategy with supporting methods and techniques, based on the philosophical assumption that practical application of a theory leading to evidence represents innovation and the research contribution [Remenyi et al, 1998]. This is in contrast to a focus on theoretical ideas that advance the body of knowledge, such as is done in some research in Computer Science. As in the case of research in Software Engineering, an empirical strategy for IT research is appropriate due to the behavioral aspects of people within the context of technology [Glass et al., 2004]. IT professionals conducting IT research often function as "reflective practitioners," linking the interests of the professional and scholarly communities [Heiskanen & Newman, 1997; Moody, 2000].

Students conducting IT research must be aware of multiple research strategies and must be able to select appropriate methods based on the nature of their research problems. As "reflective practitioners," DMIT students have significant insight into the nature of their research problems, and in many cases may themselves be embedded within the solution as the research project unfolds. Students may therefore be driven to select an empirical-positivist strategy, and adopt appropriate supporting methods to develop and validate the solution by virtue of their dual role as practitioner and scholar. The Research Methodology course is designed to help students consider the most appropriate research strategy for their research problems in light of their unique position of conducting research in the workplace.

V. COURSE DESIGN AND PEDAGOGICAL APPROACH

Students enroll in the IT Research Methodology course in the last semester of their DMIT coursework (see Appendix 2). The course prepares students to develop a research proposal for a given research problem, defend the proposed research and hypothesis stated in the proposal, conduct the research project according to a sound research design, validate the hypothesis and answer to the stated research questions. This section describes the course design and pedagogical approach used.

COURSE DESIGN

The IT Research Methodology course was designed to cultivate the necessary competencies to conduct doctoral dissertation research with the goal and objectives listed in Table 3 in mind. The design endorses outcomes in the following categories consistent with the rationale of the DMIT program:

1. Theoretical outcomes - define the concepts, principles and methods in the field of IT research that a student should master.

2. Informing of practice - knowledge and awareness of best practices in applied research methodology as found in business and industry in the field of IT Management.

3. Informational outcomes – awareness of leading-edge trends and topics in IT research that a student should be aware of.

4. Skill-sets – competencies in initiating, planning and executing IT research projects.

In addition the following thematic areas of scholarship and practice are addressed:

1. Abstraction - understanding, analyzing and modeling of the problem space at various levels of abstraction. This involves complex learning with the ability to generate innovative application of theory corresponding to levels 4 and 5 of Bloom's learning taxonomy [Bloom and Krathwohl, 1956].

2. Process - knowledge of best practices in planning and conducting the processes involved in applied IT research. The process model in Figure 1 is viewed as generic and to be used by students to evolve their own conception of research, while providing a common language and process for students and faculty members to collaborate on the development of dissertation research proposals.

3. Leadership – prioritizing and specifying a research agenda in terms of an IT strategy, in alignment with an enterprise strategy.

Table 3. Educational Goal and Objectives of Research Methodology Course

Educational Goal
To expose students to a range of research methods, including methods of investigation in preparation for the dissertation research project.
Objectives
• Assist students in identifying pertinent research topics that call for innovative solutions using IT systems.

- Equip students with the ability to critique research ideas and designs.
- Examine scientific methods of research as relevant to the application of IT theory to innovation in practice.
- Enable students to formulate a research proposal which includes an appropriate research design for the topic under study.
- Determine an appropriate method of investigation for the chosen research topic.
- Select appropriate research validation methods.
- Communicate the requirements and expectations of doctoral level inquiry.
- Communicate practical issues of the research and dissertation process.
- Equip students to document their research in a dissertation and research articles.

COURSE PEDAGOGY

The course pedagogy was designed based on the objectives outlined in Table 3 to best address the syllabus topics summarized in Appendix I, and was informed by the overall design and delivery of other doctoral courses. As we are encouraging students to adopt accepted IT research methods in their individual research projects several faculty members participate in the course to provide students with a range of perspectives on potential research strategies, approaches and methods. The course is offered as a series of hybrid research seminars, where each seminar is led by a faculty member addressing a predetermined selection of topics contained in the course syllabus. On-site seminars include one or more lectures, presentations, and discussions during which sharing of ideas are encouraged. The on-site seminars are scheduled every two weeks during the semester, with the intervening time devoted to online sessions during which students collaborate online and complete the assignment given in the prior on-site seminar (a representative schedule is shown in Table 4). The course is supported by the Blackboard® Learning System, which enables faculty members and students to share articles, input, and feedback throughout the course.

Table 4. Seminar and Assignment Schedule

Seminar	On-site	On-line	Assignment Due	Credit
1	September 9	September 16	September 23	200
2	September 23	September 30	October 7	200
3	October 7	October 14	October 21	200
4	October 21	October 28	November 4	200
5	November 4	November 11	November 18	200
6	December 2	December 9	Portfolios – December 2	200

The pedagogical assumption is that there is no one "correct" approach to designing a research project, although inappropriate approaches to a given problem are analyzed during the course. In preparing for the course participating faculty members collaborate with each other to determine the content of the respective seminars. Faculty members present the selection of syllabus topics from different perspectives thereby providing students with opportunities to evaluate and integrate these perspectives to obtain their own insight. This approach has resulted in a rich learning experience where students and faculty alike are encouraged to reflect, compare, challenge, restate, summarize, integrate, and apply their ideas thereby enhancing their skills to define, design and conduct research projects. Seminar assignments are completed under the guidance of the respective faculty members (refer to Appendix III for examples).

To illustrate the pedagogy the first two seminars are reviewed here. Seminar 1 provides an overview of the pedagogical approach to be followed, and explains the relevance of the course for research in terms of the research process model (refer Figure 1). Students are informed about the relationship of the syllabus and the processes in the research process model, and encouraged to interpret it for their own prospective research projects [Steenkamp, 2005]. Seminar 1 also provides an overview of research strategy and supporting methods. In Seminar 2 the determination of the research problem through problem analysis, formulating research questions, propositions and hypotheses are examined. As part of

Seminar 2 a university research librarian reviews the available resources at the university, including the various digital journals and databases accessible on and off campus. This provides further linkage to the research process model and insures that students use reputable academic journal resources for their work in the course [McCord, 2005]. Seminars 3, 4 and 5 focus on other pre-selected topics, including qualitative methods, case study methods, statistical techniques, and ways of demonstrating concept, and reinforce the importance of literature reviews during the research process.

Seminar 6 is conducted by the students, during which they present their own ideas about IT research to the teaching team in the form of individual presentations. This may include a research proposal that is being considered for possible dissertation research. Students provide an overview of the research topic and explain the rationale for the research approach that may be used to conduct the investigation. Students are encouraged to relate their presentation to the processes and frameworks introduced during the seminars. A facilitated discussion follows each presentation, where students and faculty members pose follow-up questions and offer suggestions to improve the research proposal. Seminar 6 introduces students to the type of questioning and dialog that they will experience in working with their dissertation committees and during their proposal defenses.

SEMINAR ASSIGNMENTS AND ASSESSMENT

Seminar assignments are designed by the teaching team to reinforce the topics addressed in the respective seminars, and are intended to inform students about how to conduct the research processes, and select methods and tools to perform their own dissertation research project. Examples of individual assignments, posed by the authors in their respective seminars, are summarized in Appendix III.

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The final assignment of the course requires that each student prepare a portfolio containing all the course materials, research articles, and assignments of the five seminars, as well as a copy of the student's presentation given in Seminar 6. The portfolio serves as a personalized record of the seminars, and students subsequently reference it during the research phase.

The course concludes with a debriefing session, where students comment on their experiences in the course, and offer suggestions for improvement in the respective seminars, the linkage between seminars, and the course as a whole. Students also complete a confidential course evaluation administered by the College of Management.

Faculty members assess the students' performance on individual assignments in their respective seminars, and provide written feedback to the students on their work. During Seminar 6 each faculty member provides a written critique of the students' presentations using a pre-designed template. Students also comment on their peers' presentations, and a summary of these remarks are returned to the students along with comments from faculty members. Faculty members evaluate the student portfolios and submit all grades to the course coordinator, who is responsible for integrating the grades.

VI. SUMMARY AND CONCLUSIONS

The IT Research Methodology course described in the paper represents an innovative approach to teaching research methods to IT doctoral students. The contribution is that students benefit from the active participation of supervising faculty members in leading seminars, and in providing their unique perspectives on the research process. Consistent with the university's model of "Theory and Practice," students also benefit from applying the theories, processes, and frameworks, introduced in the seminars, to potential research questions of practice relevant to their own research interests. The student has the opportunity to present a research proposal for a potential research project to the faculty team

and their fellow students thereby building a bridge between theory and practice. This presentation helps the student to focus on a specific topic, and provides an orientation for the proposal defense and future work with the dissertation committee.

The course prepares students for entering the research phase of their doctoral program, and provides them with common processes and frameworks for considering research questions, conducting literature reviews, mapping concepts and the lineage of ideas, writing research questions, propositions and hypotheses, and considering appropriate research methods. Students and faculty members therefore share a "common research language", which promotes information exchange and dialog among students and faculty members.

Based on a review of student course evaluations after offering the course three times, we have identified several areas for improvement and modification of the research methods course as explained below.

PLACEMENT WITHIN CURRICULUM

Up to the present the course has been offered in the last term of coursework prior to beginning the dissertation phase (see Appendix I). Consideration is being given to advancing the IT Research Methodology course earlier in the curriculum. One of the reasons in favor of this is that the core courses address research-based issues and students would benefit from having exposure to research processes and methods earlier in their curriculum. Moreover, faculty members are encouraged to discuss potential research interests with students from the start of the program.

SYLLABUS AND CHOICE OF TEXTBOOKS

The range of topics of the syllabus should be explored within the context of IT research. Although these topics are generally taught in graduate courses they are not readily addressed in IT education as is done in this course. Several

textbooks are used as prescribed reading, including a text on qualitative, quantitative and mixed methods approaches to research design [Cresswell, 2003], a text on problem solving [Polya, 1957], a text on a systematic approach to writing a doctoral dissertation [Davis et al, 1997], and a text on case study research [Yin, 2003]. In addition to other recommended references a text focusing on research in business and management [Remenyi et al, 1998] has been chosen for the current offering of the course and early indications are that students find it more relevant for IT research. Students are involved in building the research literature referenced in the DMIT program as they complete their assignments for the seminars.

COORDINATION AND REFRESHING OF ASSIGNMENTS

Feedback from students indicates that the seminar assignments give them the opportunity to explore a variety of topics in the IT area, and clarify their understanding of the research process. The idea of compiling a portfolio is proving to be beneficial since it forms a good basis for the literature review phase in the dissertation research.

GRADING

Each seminar is graded by the responsible faculty member. The final seminar takes the form of student presentations, with student portfolios due at the same time. The presentations and portfolios are assessed jointly by the teaching team. The course grade is the summation of the student's performance in all seminars and is compiled by the course coordinator. This assessment approach will be continued.

APPROACH AND PEDAGOGY

On the whole students have responded positively to the approach and course pedagogy, with appreciation for the wide exposure to the field of research

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methodology. It is inevitable that some duplication occurs in the seminars when covering topics such as proposal development and methods of investigation, but this is regarded as beneficial since more than one perspective is provided and students and faculty alike are encouraged to review their perspectives as the course unfolds.

Students from three cohorts are currently in the research stage of the DMIT program, conducting their dissertation research under direction of their supervisors, and supported by members of their dissertation committees. Students and faculty members continue to use the approaches and frameworks introduced in the IT Research Methodology course to guide students' dissertation efforts, especially in the early phases of selecting research topics, developing research questions, hypotheses and propositions, and research design. The approach represents a contribution to teaching IT research methodology and can serve as a model for similar courses in other doctoral IT programs.

VI. ACKNOWLEDGEMENTS

VII. REFERENCES

Anson, C.M., R.A. Schwegler and M.F. Muth (2003) The Longman Writer's Companion, Longham.

Barki, H., S. Rivard and J. Talbot (1988) "An Information Systems Keyword Classification Scheme", *MIS Quarterly*, Vol.12, No.2, pp.299-322.

Benbasat, I. (1984) "An Analysis of Research Methodologies", in W.F. McFarlan (ed.), *The Information Systems Research Challenge*, Harvard Business School

Press, pp.47-85.

Bloom, B. and D. Krathwohl (1956) Taxonomy of Educational Objectives: The Classification of Educational Goals, (by a committee of college and university examiners), Handbook I: Cognitive Domain.

Brinkkemper, S. and E.D. Falkenberg (1991) "Three Dichotomies in the Information System Methodology", in P.W.G. Bots, H.G. Sol and I.G. Sprinkhuizen-Kuyper (eds.), *Information Systems on the Move*, Kluwer Bedrijfswetenschappe.

Butler, S. (1999) "Knowledge Management Directions: an Architectural Framework", *DM Review*, June.

Choudrie, J. and Y.K. Dwivedi (2005) "Investigating the Research Approaches for ExaminingTechnology Adoption Issues", *Journal of Research Practice*, Vol.1, Issues 1.

Creswell, J. W. (2003) Research Design – Qualitative, Quantitative and Mixed Methods Approaches. Second Edition, Sage Publications.

Davis, G.B. (1992) "Systems Analysis and Design: A Research Strategy Macro-Analysis", In Cotterman and Senn (eds.), *Challenges and Strategies for Research in Systems Development*, John Wiley & Sons.

Davis, G.B., G. David, and C. Parker (1997) Writing the Doctoral Dissertation: A Systematic Approach, Second Edition, Barron's Educational Series.

Dunleavy, P. (2003) Authoring a PhD, How to Plan, Draft, Write and Finish a Doctoral Thesis or Dissertation, Palgrave Macmillan.

Galliers, R.D. and F.F. Land (1987) "Choosing Appropriate Information Systems Research Methodologies", *Communications of the ACM*, Vol.30, No. 11.

Galliers, R. (1992) Information Systems Research, Issues, Methods and Practical Guidelines, Alfred Waller Information Systems Series, Henley-on-Thames.

Glass, R.L., V. Ramesh and I. Vessey (2004). "An Analysis of Research in

Computing Disciplines", *Communications of the AC*M, 47:6, 89-94.

Harmon, P. (2002) "Who's profiting from Business Process Redesign?", Cutter Consortium.

Heiskanen, A. and M. Newman (1997) "Bridging the gap between information systems research and practice: the reflective practitioner as a researcher", *Proceedings of the Eighteenth International Conference on Information Systems*, 121-132.

Hevner, A.R., S.T. March, J. Park and S. Ram (2004) "Design Science in Information Systems Research", *MIS Quarterly*, Vol.28, No. 1.

ISR (2002) "Editorial Statement and Policy," Inside Front Cover, *Information Systems Research,* 13:4, December.

Kitchenham, B.A., L.M. Pfleeger, L.M. Pickard, P.W. Jones, D.C. Hoaglin, K.E. Eman and J. Rosenberg (2002) "Prelim*inary Guidelines for Empirical Research in Software Engineering",* IEEE Trans. SE, Vol. 28, No.8.

March, S.T. and G.F. Smith (1995) "Design and Natural Science Research on Information Technology", *Decision Support Systems*, Vol. 15, no 4, pp 251-266.

McCord, S.A. (2005) MIS7813 Seminar 2 Notes.

Moody, D.L. (2000) "Building links between IS research and professional practice: improving the relevance and impact of IS research", *Proceedings of the Twenty first International Conference on Information Systems*, 351-360.

Nunamaker, J.F., M. Chen and T.D.M. Purdin (1990-1991) "Systems Development in Information Systems Research", *Journal of Management Information Systems*, Vol. 7, No. 3, pp.89-106.

Polya, G. (1957) How to Solve it, Second Edition, Princeton University Press.

Remenyi, D. (1990) Strategic Information Systems: Current Practice and Guidelines, Doctoral Dissertation, Henley Management College, United Kingdom.

Remenyi, D., B. Williams, A. Money and E. Swartz (1998) Doing Research in Business and Management, Sage, pp.73.

Scott Morton, M.S. (1984) "The State of Art of Research", in F.W. McFarlan (ed.), *The Information Systems Research Challenge*, Harvard Business School Press, pp.13-41.

Shull, F, J. Carver and G.H. Travassos (2001) "An Empirical Methodology for Introducing Software Processes", *ACM SIGSOFT Software Engineering Notes*, Vol. 26., Issue 5.

Steenkamp, A.L. and L.A. DeGennaro (2004) "Design and Implementation of Doctorate of Management in Information Technology", *Information Systems Education Journal*, Vol. 2, No.2.

Steenkamp, A.L. (2005) MIS7813 Tutorial Letter 1 and Seminar 1 Notes.

Weber, R. (1987) "Toward a Theory of Artifacts: a Paradigmatic Base for Information Systems Research", *Journal of Information Systems*, Vol. 1, No. 2, pp. 3-19.

Willcocks, L., D.F. Feeny and G. Islei (1997) Managing IT as a Strategic Resource, McGraw-Hill.

Wilson, E.J. (2005) "Engaged Scholars and Thoughtful Practitioners: Enhancing Their Dialogue in the Knowledge Society", *Information Technologies & International Development*, 2:4, 89-92.

Yin, R. (2003) Case Study Research: Design and Methods, Third Edition, Sage Publications.

APPENDIX I. OVERVIEW SYLLABUS

Course Topics	
Dissertation Research Prospectus	Analogy Decomposing and recombining
Research approach	Heuristic reasoning
Methods of investigation	Induction
Research process models	Testing by dimension
Research planning	Identifying a variation of the problem
Research design - experimental, quasi-experimental and non-experimental designs	Qualitative Techniques
Research deliverables	Collect, organize and analyze qualitative data
Proposal Development	Interviewing
Problem statement	Focus groups
Scope determination	Action research
Hypotheses and axioms	Content analysis
Methods of investigation	Secondary data
Validation of hypothesis	Design, sampling
Format of research proposal	Field research
Research Approaches	Quantitative Techniques
Scientific Methods of Research - theoretical and empirical approaches	Design of experiments
Positivist, Empirical, Non-Positivist, Phenomenological approaches	Survey research
Qualitative versus Quantitative Paradigms	Collect, organize, analyze, test and validate quantitative data
Modeling approaches and taxonomies	Statistical techniques
Research Techniques	Demonstration of concept
Problem analysis and definition	Prototyping, simulation, virtualization
Review, analysis, evaluation, interpretation, synthesis	Approaches to research validation
Theory development and conceptual modeling	Concepts of validity and reliability
	Critiquing of research articles
	Format of dissertation

APPENDIX II. DMIT CURRICULUM SCHEDULE

Term	Major Track	Credit	Minor Track	Credit	Research Meths. Track	Credit	Total Credit
Term 1	IT Life Cycle Processes	3			Quantitative Methods I	3	6
Term2	Advanced Data Management	6	Minor 1	3			12
Term 3			Minor 2	6			15
Term 4	IT Leadership & Management	9			Quantitative Methods II	6	21
Term 5	IT Systems Architecture	12	Minor 3	9			27
Term 6					Modeling and Simulation	9	30
Term 7	Advanced Topics in IS	15			IT Research Methodology	12	36
COMPREHENSIVE EXAMINATION							
Term 8	Dissertation proposal DIS8013	3					39
Term 9	DIS8023 & DIS8033	9					45
Term 10	DIS8043 & DIS8053	15					51
Term 11	DIS8063 & DIS8073	21					57
Term 12	DIS8083	24					60
DISSERTATION DEFENSE							
EARLIEST GRADUATION							

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APPENDIX III. EXAMPLE SEMINAR ASSIGNMENTS

Assignment 1
Students are asked to identify a research question in a journal article and to determine and explain what approach would be best to study the question. Students locate a journal article which represents quantitative, qualitative or mixed methods research, and identify the "markings" that indicate its method. Next, students are asked to select a topic they would like to study and, using the combinations of knowledge claims, strategies of inquiry, and methods described in the Cresswell (2003), discuss how the topic might be studied using each of the combinations. As a follow-up students prepare an outline proposal of a research project related to their topic. Lastly students critique an assigned article using evaluation criteria including: relevance to IT research, clarity of objectives, quality of planned methodology, quality of evidence, logical development and flow of arguments, appropriateness of citations, and editorial consistency and finish.
Assignment 2
Students are provided with a model framework for identifying, assessing, and improving research questions, and for reviewing academic literature sources in the realm of focal theory. Students are asked to propose multiple research questions using the model framework to identify the most promising of these questions. Students then identify several academic journal articles in the related focal area, review those articles, and use concept mapping software to map the relationships between the concepts and citations found in the articles. While FreeMind, an open source concept mapping tool, has been recommended (refer http://freemind.sourceforge.net), any concept mapping software may be used. Following the review of focal theory literature, students are asked to propose improvements to their most promising research question.

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