Mohawk College

MOHAWK COLLEGE OF APPLIED ARTS AND TECHNOLOGY
COMMUNITY ECONOMIC DEVELOPMENT

NATIONAL LITERACY SECRETARIAT

Computer Based Learning – Development an Integration into Deaf Programming

March, 2002

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1.0 PROJECT OVERVIEW

This National Literacy Secretariat (NLS) project was approved in 1998, and work by Mohawk College (MC) began shortly thereafter. At this time, the Ontario Ministry of Training, Colleges and Universities, Literacy Branch and the National Literacy Secretariat had organized NLS projects which dealt with Deaf Stream learners into a Deaf Projects cluster. Deaf cluster projects were to be overseen by a province wide group of deaf stakeholders convened by the Goal: Ontario Literacy for the Deaf (GOLD).

Mohawk College experienced a series of obstacles and staff turnover issues throughout the duration of the project, which meant that the outcomes could not be completed within the time frame originally planned. At the same time, similar obstacles were arising at the provincial level. Administrative and mandate changes at GOLD resulted in there being no stakeholders committee to act as a reference group for this or other Deaf cluster projects.

Work continued on the Computer Based Learning (CBL)- Development and Integration into Deaf Programming Project, although it was sporadic, and successive project staff sought input from a constantly changing group of stakeholders within the deaf community. Wherever possible, staff sought input and field testing of products from students in Mohawk College's Deaf Empowerment Program (DEP). However, goals and outcomes of the project have been adjusted from the original intent. For more information on these modifications, please see the Final Evaluative and Expenditure Report, submitted to NLS.

Mohawk College is pleased to report that all obstacles and setbacks were finally overcome, and in March, 2002, the project was completed.

Copies of this report have been distributed to the following agencies and individuals serving Deaf clients in the Province of Ontario:

- Leigh Garrett, Canadian National Institute for the Blind, Hamilton
- Leah Morris, Adult Basic Education Association, Hamilton
- Sandy Alyman, Canadian Hearing Society, Hamilton
- Sandra Miners, Ministry of Training, Colleges and Universities, Literacy Branch, Toronto
  Cheryl Wilson: Ontario Literacy for the Deaf, Brampton
- Sue McCarter, Barrier Free Communication to Employment, Kitchener
- Melda Wades, Hamilton District School Board
- Bill Chopp, Grand Erie District School Board, Brantford
- Natalie Alonen, Canadian Hearing Society, Brantford
- Mary Galarro, Hamilton Catholic District School Board
- Brant-Haldimand-Norfolk Catholic District School Board, Brantford
- Alana Hogsden, Canadian Hearing Society, Kitchener
- Gord Ryall, Bob Rumball Centre, North York
- Paul Ledrew, Deaf Education Centre, George Brown College, Toronto
- Cathy Cuthbertson, E.C. Drury School for the Deaf, Milton
- The Robarts School for Hearing Handicapped, London
- Laurel Roberts, Sir James Whitney School, Belleville
- Metro Toronto School for the Deaf, Toronto

Mohawk Colleges wishes to thank everyone involved in the successful completion of this project.

March, 2002

2.0 COMPUTER BASED LEARNING AND THE DEAF

Research Methodology

Research into CBL for Deaf Adult Learners (DAL) was conducted along several avenues, using three basic methods. These included:

1. Internet Searches for generic literature in the field and to identify sources of hardware and software for CBL. The results of these searches can be found in the Appendix to this document.

2. Secondary source analysis of CBL software effectiveness for DAL. Only "Top Rated" "Adult Literacy Materials" as defined by Gallaudet University have been included.

3. Primary source field testing, conducted specifically for the project, amongst DAL in the Mohawk College DEP program.

Integration to Local Programs

Through this project, Mohawk College has had the opportunity to field test a number of pieces of CBL software with students in its Deaf Empowerment Program, which is funded through the Literacy and Basic Skills - Deaf Stream Program.

Mohawk College's Library Resource Centre has acquired some CBL software for the deaf on behalf of DEP students as well as deaf students in a variety of post-secondary programs. This collection will continue to grow and be available to future DAL at the College.

Through distribution of the final report on this project, it is anticipated that the local Deaf and Adult Literacy communities in Ontario will be encouraged to consider CBL interventions and grow increasingly comfortable with the particulars of their use.

Recommendations

The decision to introduce Computer Based Learning into a classroom of literacy students is often a difficult one, for a variety of reasons. Such an undertaking is even more ambitious when those learners happen to be deaf, as well. Programs must carefully consider whether they have the resources, both human and financial to take such a step. Hidden costs may arise as a result of hardware issues like wiring, electrical outlets and computer maintenance agreements, but there is also the problem of instructors who aren't properly trained to use the software, or who don't have time to monitor learner use in any meaningful way. Finally, we must take into consideration the learners themselves, their level of computer literacy and their confidence in their own ability to master these skills, while at the same time staying motivated to improve their English competency.

The following recommendations arise out of experience gained through the field testing component of this program, wherein different types of software were introduced on a pilot basis to learners in Mohawk College's DEP Program:

- As a first step, DAL should be prepared ahead of time with some instruction in basic computer literacy, using programs of which they already know the content. This will ensure that they have mastered the fundamental knowledge required to operate a computer, before they are faced with a new challenge of independent learning using this new tool.

- Where possible, program instructors should be given support, resources and time to hone their skills in the development of instructional materials. As an adjunct to the use of CBL materials, it is helpful if learners are given supplementary materials that directly relate to the software they are currently using. In addition, instructors with a high level of skill in this area are better able to recognize CBL materials that are most appropriate for their specific learners, and to make optimum use of them.

- Consider acquiring Via Voice and Communicator Applications as worthwhile hardware additions for DAL.

Assessing Software

Introduction of Computer Based Learning materials for adult literacy training purposes should always be carefully considered, however, appropriateness of the hardware and particularly the software being used is doubly important when working with DAL. This project found the following issues helpful to assess before offering CBL programs to Literacy and Basic Skills (LBS) students:

- ensure that any sound related information, cues, feedback and functions are not essential to the operation of the hardware or software.

- look at whether operational instructions are clear, even to those with limited written English skills, and whether they are graphically represented in a manner that is easily seen and understood. For example, is print size or font type too small or confusing? Are colours complimentary and pleasing to the eye?

- use programs that focus on informational content. Too many graphics or interactive options become confusing for anyone, but particularly for DAL.

- where possible, use programs that are primarily text based rather than pictorial or graphic in nature. The more practice DAL receive in reading and deciphering written English structures will help achieve the final goal.

- look for programs that include employment related materials and content.

- carefully consider whether the information conveyed is accurate, up-to-date and logically presented.

- look for programs that allow users to control the speed at which information flows. If there is limited control over this, make sure that the programs pre-set speed is appropriate, not too fast or too slow for the learners in the program

- judge whether the type of material and reading level required are consistent with those of program learners. This is often what makes finding appropriate software so difficult. Typically, DAL function at approximately Grade 3-4 level in terms of English language skills, however Grade 3 and 4 materials are too juvenile to hold their interest in content. To overcome this, materials developed for ESL learners can be helpful, so long as they don't focus on conversational goals or use verbal training cues.

Sourcing Software

There is an abundance of suitable CBL materials available. Most are available from u.s. sources. Canadian sources are more limited.

Any instructors or learners interested in acquiring a particular piece of software should consider accessing the Software To Go Program. This is a website rating a wide range of CBL materials for the deaf, of all ages. It is maintained by the Laurent Clerc National Deaf Education Centre at Gallaudet University in Washington, D.C. The website is:

http://clercenterter.gallaudet.edu/stg/index.html

3.0

Compendium
Of
Computer Based Learning Software

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Math Mysteries
Mavis Beacon Teaches Typing 9
MP Express
Oxford Picture Dictionary
Postcards
Print Shop Deluxe
Resume Maker with Career Planning
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Talking Walls
Timeliner 4.0
Typing Tutor: Learning to Type for Today's Internet World
Virtual Labs
Vocabulary
What Colour is Your Parachute?
World Political Leaders
WOW: World of Words
Writer's Toolkit
Writing In The Real World
The Writing Trek

Introduction

When deaf adult learners (DAL's) use computer based learning (CBL) methods to learn the written form of the English language or English literacy, they find themselves with weak technical manipulative skills. DALs are often not experienced in loading CDs, manipulating a mouse and moving between screens. CD-ROMS such as **American Sign Language Dictionary on CD-ROM** and **Oxford Picture Dictionary** are excellent starting points as the content is familiar and engaging to the deaf adult learner. Learning the required technical manipulative skills for CBL can be more readily acquired if the learner is comfortable and knowledgeable of the software's content. **Aesop in ASL** and **HyperSign** include challenging interactive activities, which strengthen the DAL's technical manipulative skills. These four CBL packages are also beneficial to adults who become deaf or hard of hearing, later in life, and want to independently learn ASL and computer skills. DAL's who possess or develop strong computer literacy skills will find **Adobe ImageStyler, Dreamweaver, and MP Express** helpful in allowing them to create web pages and visual presentations.

With written English being the second language that DALs acquire, some of the English as a Second Language programming is very appropriate for enhancing English literacy. **Azar Interactive** and **Focus on Grammar** both teach basic reading and grammar skills. **Postcards and Talking Walls** provide exercises that improve composition skills. Instructors of DALs are often challenged to find activities and exercises that are engaging for adults and yet reinforce basic grammar and composition skills. **Postcards** and **Talking Walls** provide exercises and activities that improve composition skills, specifically the correct use of verb tenses and transitional words.

In 1987 the Annual Survey of Hearing Impaired Children and Youth (ASHICY) revealed reading comprehension scores of 17 year old deaf and hard of hearing students at a grade four level. The 1997 ASHICY survey indicated that the reading comprehension level of 17 year olds had dropped 0.1 to a grade level of 3.9. (Schein, J. 2000) There is a great volume of CBL designed for students in the grade three to grade six levels. These CBL are not appropriate for DALs because the content is juvenile and sound is an integral component. The following products are geared to students in grades 7-12 and sound plays a minor role in their effectiveness:
Composition, Vocabulary, and **WOW: World of Words.**

In order to enhance their English literacy, DALs must be able to retrieve research material, to assist in their composition exercises. The following CBL's provide information on a variety of topics, for DALs to incorporate into their writing assignments: 17th Century World History, Encarta 98 Encyclopedia Deluxe, Timeline 4.0, World Political Leaders.

Instructors of DAL's are often challenged to find research resources as well as curriculum ideas at the right level for mature students. Web sites created for and supported by ESL instructors can provide material for instructors of DALs. For example these two websites provide samples of quizzes and activities: Tower of English *http://towerofenglish.tripod.com/quizzes.html* and Internet TESL Journal *http://iteslj.org/.*

DALs, while needing to strengthen their computer literacy and fluency in written English, must also improve their scientific literacy. CBLs that teach about the pure and applied sciences include the following: **BARN Multimedia Series, Learn About Earth Science, Learn About Life Science, Math Arena, Math Mysteries, Sim City 3000** and **Virtual Labs.**

The will to develop computer literacy, written English literacy and scientific literacy is usually very high when DALs are seeking employment within the hearing community. DALs and their instructors will find: **EmindMaps, Inspiration, Skills Enhancer** will assist in assessing and inventorying skills. **English at School and on the Job** and Writing **In The Real World** are excellent CBLs to teach DALs about writing letters, reports, and resumes.

For DALs to effectively communicate in both hearing and non-hearing communities, keyboarding skills are paramount. Deaf chat rooms allow DALs to communicate with other deaf persons who are continents away or who do not possess ASL or finger spelling skills. Voice recognition software such as **ViaVoice** and **Communicator** has been strongly endorsed by the hearing business community.

Voice recognition software allows business people to dictate their ideas, and have their words translated into text for transmission. This software also works in reverse, translating text into a projected voice. Voice recognition software will allow DALs to playa much greater, and more independent role in the workplace. Strong keyboarding skills are however, essential. CBLs such as **Mavis Beacon Teaches Typing 9** are excellent for improving speed and accuracy at the keyboard.

The thirty-three computer based learning resources listed above are evaluated in the following compendium. These CBLs have been evaluated according to the criteria established by the Clerc Laurent National Deaf Education Center at Gallaudet University in Washington DC. See A Software to Go Evaluation Guidelines" at *http://clerccenter2.gallaudet.edu/stg/how-toevaluate.html*. These items have been rated 3.5, 4, or 5 out of a possible 5. Instructors wishing to determine how other teaching faculty have rated specific CBLs for DALs should search the Clerc Laurent website at *http://clerccenter2.gallaudet.edu/*

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Jones, E. (1991). ***Deaf*** *children's* knowledge of internal human anatomy. *Journal of Special Education,* 25(2), 9pp. Retrieved October 25,2001, from EBSCOhost database. (MasterFILE Elite).

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17th - Century World History

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	ABC-CLIO http://www.abc-clio.com/
VERSION/CONTENTS:	Version: 2000 Contents: I CD-ROM, I User Guide
HARDWARE REQUIREMENTS:	PC CD-ROM
OPERATING SYSTEMS:	Win 98
COST:	$35. US (Excluding taxes and shipping)
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	Middle (7-9) Secondary (9-12) Adult
SUBJECT AREA (S):	Primary: Social Studies Secondary: Cross Curricular
INSTRUCTIONAL MODE:	Creative Activity Multimedia Reference
SOUND:	No sound
DESCRIPTION:	Provides a wealth of primary-source and general-reference information related to the study of 17th century world history. The curriculum-specific resources include nearly 800 images, documents, maps, quotes, statistics, biographical events, and organization profiles. Allows users to print, copy, and export all the resources on the CD-ROM. And provides the necessary tools to create multimedia presentations and reports.
REVIEWER COMMENTS:	Allows multimedia manipulation and creativity for producing presentations and reports. Information presented is authoritative, reliable, and sufficient for general reference purposes.
REVIEWER /DATE: (Review originally submitted to Laurent Clerc National Deaf Education Center)	L. Canlas 8/22/2001
ADDITIONAL INFORMATION:	19th- Century World History and 20th- Century World History now available for purchase on CD-ROM for $79. US at http://www.abc-clio.com/

Adobe ImageStyler

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	5
PUBLISHER:	Adobe
VERSION/CONTENTS:	Version: 1.0 Contents: 1 CD-ROM 1 User Guide
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM
OPERATING SYSTEMS:	Macintosh System 8 Power Mac Win 95, 98, NT
COST:	$84.95 US (Excluding taxes and shipping)
PRIORITIES:	
APPROPRIATE FOR GRADES/LEVELS:	Secondary (9-12) Adult
SUBJECT AREA(S):	Primary: Internet/WWW Secondary: Art
INSTRUCTIONAL MODE:	Computer Programming Tool
SOUND:	No sound
DESCRIPTION:	A set of tools for creating Web-based graphics. Designed for the non-professional. Allows users to produce JavaScript rollover effects, image maps, and optimized graphics in a few quick steps.
REVIEWER COMMENTS:	Although it helps to have experience with PhotoShop, you don't have to know that program to take advantage of the features of ImageStyler. First time users should do the tutorial.
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Ken Kurlychek 4/15/1999
ADDITIONAL INFORMATION:	A review appearing on http://www.amazon.com/ notes that Adobe is no longer distributing Imagestyle. Adobe has introduced the following new products to succeed Imagestyler, Illustrator, PhotoShop and Go Live.

Aesop in ASL

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	5
PUBLISHER:	Texas School for the Deaf www.tsd.state.tx.us/
VERSION/CONTENTS:	Version: 1996 Contents: 1 CD-ROM
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM Sound Card
OPERATING SYSTEMS:	Macintosh System 7 & 8 Power Mac Win 95 & 98
COST:	$59.95 US (Excluding taxes and shipping)
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	Middle (7-9) Secondary (9-12)
SUBJECT AREA(S):	Primary: Language Arts Secondary:
INSTRUCTIONAL MODE:	Demonstration/Presentation Drill and Practice
SOUND:	Minor
DESCRIPTION:	The second CD-ROM produced by the Texas School for the Deaf, takes the text from four of Aesop's Fables and adds ASL movies, animation, and a speech component. The fables include: The Milkmaid and her Pail, The Tortoise and The Hare, Fox and the Grapes, and The Lion and the Mouse. At the end of each story are five activities that enable the user to practice skills regarding pronouns, sequencing, reading comprehension, synonyms and vocabulary.
REVIEWER COMMENTS:	This software is very interactive and the students love to watch the storytellers sign the stories. The story questions are good but are posed only in English. The pronoun activities are useful for learning subject pronouns. Unfortunately, there is only one sequencing activity for each story and the sentences are not produced in ASL. The Vocabulary and Synonym activities would be better if words were presented in context.
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Rosemary Stifter 2/23/2001
ADDITIONAL INFORMATION:	More products and www links to relevant materials can be found at the Texas School for the Deaf website: www.tsd.state.tx.us/

The Alphabet for Windows

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Protea Textware Grass Roots Press P.O. Box 52192 Edmonton, Alberta T6G *2T5* 1-888-303-3213 fax: (780) 413-6582 grassrt@telusplanet.net/ http://www.literacyservices.com/
VERSION/CONTENTS:	Version: 1997 Contents: Multimedia Interactive CD
HARDWARE REQUIREMENTS:	PC - 486 16mbRAM 16 bit colour 640x480 display CD ROM Mouse
OPERATING SYSTEMS:	Macintosh Win 3.1, 9x, NT
COST:	$90 Cdn.
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Level I Not recommended for Usher's Syndrome Learners
SUBJECT AREA (S):	Language
INSTRUCTIONAL MODE:	
SOUND	none
DESCRIPTION:	The CD teaches and tests the names of English letters, upper and lower case matching, alphabetical ordering and keyboarding familiarity. Spelling activities for common sight words are also provided
REVIEWER COMMENTS:	The software is well laid out and visually appealing, however, DAL's will require some assistance in ASL on opening and navigating the program. This software is also good for non ASL speakers.
REVIEWER DATE:	Bruce Belcher 09/30/2001
ADDITIONAL INFORMATION:	Learners are unable to install the software, due to the language contents of the "pop-up" screens.

American Sign Language Dictionary on CD-ROM

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Multimedia 2000 (originally by HarperCollins)
VERSION/CONTENTS:	Version: 1.0 Contents: 1 CD-ROM
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM
OPERATING SYSTEMS:	Macintosh System 7 Win 95
COST: PRIORITIES:	$29.95 US (Excluding taxes and shipping) ASL
APPROPRIATE FOR GRADES/LEVELS:	Primary (1-3) Elementary (4-6) Middle (7-9) Secondary (9-12) Adult
SUBJECT AREA(S):	Primary: Sign Language Secondary:
INSTRUCTIONAL MODE:	Drill and Practice Guided Practice Reference
SOUND:	Minor
DESCRIPTION:	Guides users from the settlement of the frontier through the growth of industry, the two World Wars and the Clinton presidency. Review book format contains over 800 questions covering 15 topics. Highlights events from 1862 to 1994.
REVIEWER COMMENTS:	Technically, the video clips used on ASL/CD-ROM were somewhat grainy and occasionally jumpy on our 486 computer with a double speed CD drive. But we liked the option of controlling the speed. Presentation, helpful for practicing receptive skills and comprehension. Another important advantage is the ability to print video stills from the Dictionary section. Navigating between sections is obvious and easily done.
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Ken Kurlychek 3/25/1999
ADDITIONAL INFORMATION:	The 1994 edition of this CD-ROM and its corresponding guide, have be part of the Mohawk College Library Resource Collection for more than five years. This title has the LC call number HV24475.S7834 1994, and has been heavily used by Deaf Empowerment students and instructors.

Amphibians and Reptiles

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	ICE - Integrated Communications and Entertainment Inc. 489 Queen St. E. Toronto, Ont. M5A IVI 1-416-868-6423 fax: (416) 367-8996 http://www.juniorguides.com/
VERSION/CONTENTS:	Version: 2.03 -1997 Contents: Multimedia Interactive CD
HARDWARE REQUIREMENTS:	8MBRAM 12 MB hard drive space High Speed CD ROM SVGA monitor 256 colour
OPERATING SYSTEMS:	Windows 3.1, 9x
COST:	$29.99 US
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 1-3
SUBJECT AREA (S):	Reference
INSTRUCTIONAL MODE:	
SOUND	none
DESCRIPTION:	This software contains 3-D activities that highlight information about amphibians and reptiles, including a Field Kit. Contents include: Backyards and Parks, Forests and Woodlands, Streams and Rivers, Lakes, Ponds and Marshes, Prairies and Grasslands, Deserts and Arid Scrub. Listings of websites, organizations and reference materials for further information are also provided.
REVIEWER COMMENTS:	Learners find the information fascinating. ASL assistance is required on opening and navigating the program. This software provided opportunities for learners to improve spelling and vocabulary skills. Pictures are very rich in colour. The virtual classroom feature was very helpful.
REVIEWER DATE:	Bruce Belcher 09/30/2001
ADDITIONAL INFORMATION:	

Azar Interactive: A Multimedia Grammar Experience

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 200 I.

	3.5
PUBLISHER:	Prentice Hall
VERSION/CONTENTS:	Version: 1998 Contents:
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM
OPERATING SYSTEMS:	Windows 3.1 Windows 95
COST:	$177.50 US (Excluding taxes and shipping)
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	Secondary (9-12) Adult
SUBJECT AREA(S):	Primary: Grammar Secondary:
INSTRUCTIONAL MODE:	Drill and Practice Guided Practice
SOUND:	Major
DESCRIPTION:	Azar Interactive offers clearly focused grammar exercises, innovative video clips, original audio segments, and a variety of readings that present grammar in context. Includes 80 Azar Grammar Charts, numerous grammar exercises, and 50 grammar topics along with 70+ video, audio, and reading extension activities. Provides a solid foundation for grammar exploration. Grammar topics include verb tenses, auxiliaries, nouns, pronouns, articles, adjectives, adverbs, and high-frequency sentence patterns.
REVIEWER COMMENTS:	Question types are the usual multiple choice, click-and-drag, and fill-in-the-blanks. All the students I observed using the CD had no trouble figuring out what to do with the keyboard or cursor or navigating from lesson to lesson. For the type-in answers, the standard pressing the return or enter key to get your answer' clears what is typed, a minor inconvenience easily adjusted to. The 100 minutes of audio on this CD-ROM would be problematic for deaf and hard of hearing users. This audio portion is clearly intended for ESL students who need to improve their conversation and listening skills ..

REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Brian Rhodes, Okanagan University College 12/17/1999 Jim Duber 12/28/1999 http://www-writing.berkeley.edu/
ADDITIONAL INFORMATION:	This title is in the collection of Mohawk College Library. It has the LC call number PE I 065.A92 1998 and is available to Deaf Empowerment students and instructors. More titles available at: http://www.phregents.com/

BARN Multimedia Series B Interactive Software for Safe, Healthy Choices

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Learning Multi-Systems http://www.imssite.com/
VERSION/CONTENTS:	Version: 1998 Contents: 4 CD-ROMs, a Teachers Activity Resource Book and a Student Portfolio Workbook
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM
OPERATING SYSTEMS:	Macintosh System 7 & 8 Win 95, 98 & NT
COST:	$295. US (Excluding taxes and shipping)
PRIORITIES:	Transition
APPROPRIATE FOR GRADES/LEVELS:	Secondary (9-12)
SUBJECT AREA(S):	Primary: Health Secondary: Problem Solving/Logic
INSTRUCTIONAL MODE:	Exploration Multimedia
SOUND:	Moderate
DESCRIPTION:	The Body Awareness Resource Network (BARN) is a computer-based system that provides health information to adolescents in the following major content areas: Alcohol & Other Drugs, Body Management, Smoking and Management.
REVIEWER COMMENTS:	Visually friendly and interesting, includes a series of videos of teenagers discussing the topic in a radio talk-show format.
REVIEWER /DA TE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Alexis Greeves 8/22/2001
ADDITIONAL INFORMATION:	The Learning Multi-Systems: Technology to Inspire Learning Company has another four part health- related series focusing on: 1.HIV/AIDS 2. Alcohol and other Drugs 3. Human Sexuality I B A Healthy Me 4. Human Sexuality 2 B Respect and Responsibility This series sells for $295. US http://www.Imssite.com/

Birds

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	ICE - Integrated Communications and Entertainment Inc. 489 Queen St. E. Toronto, Ont. M5A IVI 1-416-868-6423 fax: (416) 367-8996 http://www.juniorguides.com/
VERSION/CONTENTS:	Version: 2.03 - 1997 Contents: Multimedia Interactive CD
HARDWARE REQUIREMENTS:	8MB RAM 12 MB hard drive space High Speed CD ROM SVGA monitor 256 colour
OPERATING SYSTEMS:	Windows 3.1, 95
COST:	$29.99 US
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 1-3
SUBJECT AREA (S):	Reference
INSTRUCTIONAL MODE:	
SOUND	none
DESCRIPTION:	This software contains 3-D activities that highlight information about birds, including a Field Kit. Contents include: City Parks and Suburbs, Broad-leaved Forest, Grassland and Savanna, Desert and Mesquite, Evergreen Forest, Seashores, Lakes, Rivers and Marshes. Listings of websites, organizations and reference materials for further information are also provided.
REVIEWER COMMENTS:	Learners find the information fascinating. ASL assistance is required on opening and navigating the program. This software provided opportunities for learners to improve spelling and vocabulary skills. Pictures are very rich in colour. The virtual classroom feature was very helpful.
REVIEWER DATE:	Bruce Belcher 09/30/2001
ADDITIONAL INFORMATION:	

Body Works

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1- Poor to 5- Excellent	4
PUBLISHER:	The Learning Co. I Athenaeum St. Cambridge, MA 02142 1-800-227-5609 fax: on request support@learningco.com/ http://www.learningco.com/
VERSION/CONTENTS:	Version: 6.01 -1997 Contents: Multimedia Interactive CD
HARDWARE REQUIREMENTS:	8MBRAM 12 MB hard drive space High Speed CD ROM SVGA monitor 256 colour Windows compatible sound card Mouse On-line access 486DX/33 Mhz Intel MMX
OPERATING SYSTEMS:	Windows 3.1,95
COST:	$49.95 US
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 1-5
SUBJECT AREA (S):	Reference
INSTRUCTIONAL MODE:	
SOUND	yes, but not essential
DESCRIPTION:	The program contains a high level of detail about human anatomy. Using extensive audio-visual enhancements to text, a variety of body functions and their interaction are demonstrated, familiarizing learners with terms. A virtual classroom, complete with personal instructor offers 15 different presentations. Quizzes and tests are also provided.

REVIEWER COMMENTS:	Learners find the information fascinating, although learners below level 3 will find the text too advanced. ASL assistance is required on opening and navigating the program. This software provided opportunities for learners to improve spelling and vocabulary skills. Additional research into terminology is often required.
REVIEWER DATE:	Bruce Belcher *09/30/2001*
ADDITIONAL INFORMATION:	Installation and use of the program requires knowledge of Acrobat Reader and Quicktime

Canadian Encyclopedia - Student Edition

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	McClelland & Stewart 481 University Ave. Suite 900 Toronto, Ont. M5G 2E9 1-416-598-1114 fax: (416) 598-7764 salesdept@mcclelland.com/ http://www.mcclelland.com/
VERSION/CONTENTS:	Version: 1.0 -1998 Contents: Multimedia Interactive CD
HARDWARE REQUIREMENTS:	Pentium 32MB RAM 150 MB hard drive space 6x CD ROM 800 x 600 display 16 bit colour Mouse
OPERATING SYSTEMS:	Windows 9x, NT
COST:	$39.95 Cdn.
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 1-5
SUBJECT AREA (S):	Reference
INSTRUCTIONAL MODE:	
SOUND	none
DESCRIPTION:	This software allows learners to either "explore" using multimedia presentations on Canadian culture and history, or "find" specific information about art, architecture, the constitution, sports, literature and innovation. Learners can personalize their own "binder" of information by copying either pictures or text from a variety of sources. There are over 5000 entries, 4000 multimedia items and thousands of photos. An internet link is available allowing learners to progress to using an additional?, well constructed, teaching modules beginning at Grade 4 level.

REVIEWER COMMENTS:	Contents are very clear to learners browsing the program. This software provided opportunities for learners to improve spelling and vocabulary skills.
REVIEWER DATE:	Bruce Belcher *09/30/2001*
ADDITIONAL INFORMATION:	

Canadian Encyclopedia - World Edition

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	McClelland & Stewart 481 University Ave. Suite 900 Toronto, Ont. M5G 2E9 1-416-598-1114 fax: (416) 598-7764 salesdept@mcclelland.com/ http://www.mcclelland.com/
VERSION/CONTENTS:	Version: 5.0 Contents: Multimedia Interactive CD
HARDWARE REQUIREMENTS:	486 16 MB RAM CD ROM 640 x 480 display 16 bit colour Mouse
OPERATING SYSTEMS:	Windows 3.1, 9x, NT
COST:	$39.95 Cdn.
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 1-5
SUBJECT AREA (S):	Reference
INSTRUCTIONAL MODE:	
SOUND	none
DESCRIPTION:	This bilingual program focuses on Canadian information, containing 4 CD's with 60,000 English and 10,000 French articles, 11,000 photos, 250 videos, a thesaurus, The Globe and Mail Style Book, and a French/English dictionary. Also included is the Hutchinson Multimedia Encyclopedia with 50,000 international entries. Other features include a section on the Lives and Times of Canadian Prime Ministers, and Canucklehead; an interactive and irreverent quiz game.
REVIEWER COMMENTS:	This software provided opportunities for learners to improve spelling and vocabulary skills through the virtual classroom feature. Instructional screens are clear and easy to comprehend.

REVIEWER DATE:	Bruce Belcher *09/30/2001*
ADDITIONAL INFORMATION:	

Composition

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	3. 5
PUBLISHER:	Super Tutor Company http://www.1stchoicesoftware.org/
VERSION/CONTENTS:	Version: 1998 Contents: CD-ROM User Manual
HARDWARE REQUIREMENTS:	PC CD-ROM
OPERATING SYSTEMS:	Windows 95 or later
COST:	$29.95 US (Excluding taxes and shipping)
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	Secondary (9-12) Adult
SUBJECT AREA(S):	Primary: Composition Secondary: Creative writing
INSTRUCTIONAL MODE:	Demonstration/Presentation Guided Practice Tutorial
SOUND:	Minor
DESCRIPTION:	<u>The Writing Process</u> *Why You Should Write *Getting Started *Writing and Rewriting *Good Writing Habits <u>Good Writing Style</u> *Choosing Your Tone *Refining Your Style *Paragraph Structure *Proofreading <u>Research Papers</u> *Collecting Sources *The Writing Process for Research Papers *Natural and Social Science Papers *English and Humanities Papers *Essay Tests Journalism *Style and Practices *Reporting the News *Writing Feature Articles *Journalism on the Web <u>Personal and Creative Writing</u> *Creative Writing *Job Applications *College Application Essays

	<u>Online Writing Activities</u> *Freewriting *Details, Details *Your Hot Links *School Newspapers *Creative Writing *Collaborative Poetry
REVIEWER COMMENTS:	Excellent source for helping students write reports and job applications.
REVIEWER /DATE	Valerie Parke,Mohawk College 10/20/01
ADDITIONAL INFORMATION:	This title is in the collection of Mohawk College Library. It has the LC call number PE 1408.C54432 1998 and is available to Deaf Empowerment students/instructors.

Compton's Learning Mathematics for Middle School

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	5
PUBLISHER:	The Learning Co. I Athenaeum St. Cambridge, MA 02142 1-617-761-3000 fax: n/a help@tlcsupport.com/ http://www.learningco.com/
VERSION/CONTENTS:	Version: 1.0 -1999 Contents: Multimedia Interactive CD
HARDWARE REQUIREMENTS:	PC - 486DX2/66MHz 20MB hard disk space 12 MB RAM 4x CD ROM 256 colour Windows compatible sound card Speakers On-line access
OPERATING SYSTEMS:	Windows 3.1,95,98
COST:	$14.95 Cdn.
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 1-4
SUBJECT AREA (S):	Mathematics
INSTRUCTIONAL MODE:	
SOUND	yes, but not essential
DESCRIPTION:	The program aims to improve math grades, enhance independent work skills, simplify complex math concepts, teach fundamental rules, definitions and reasoning. Main contents include: Pre-Algebra, Geometry, Fractions, Decimals, Measurements, Variables. The software features: interactive lessons, multimedia instruction, 1000's of practice problems, 100's of quizzes, and automatic progress reports. By going on-line, learners can ask for help, or participate in math forums.

REVIEWER COMMENTS:	Graphics are visually appealing and text is simple and clear. Learners are able to explore the software without assistance. Fonts are suitable for all types of learners. Learners can select their own program of study, exploring categories to the depth they require.
REVIEWER DATE:	Bruce Belcher *09/30/2001*
ADDITIONAL INFORMATION:	

Core Reading and Vocabulary Development

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Education Activities P.O. Box 392 Freeport, NY 11520 1-800-645-3739 fax: (516) 623-9282 learn@edact.com/ http://www.edact.com/ ISBN: 0-13-862103-9
VERSION/CONTENTS:	Version: 2.1 - 1996 Contents: Multimedia Interactive CD
HARDWARE REQUIREMENTS:	PC - CM 4 mb RAM 256 colour CD ROM Mouse Sound Card
OPERATING SYSTEMS:	Macintosh DOS or Windows
COST:	$650 Cdn. For complete pre-primer set, 18 disks Additional levels and Core Speech components available at additional cost
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 1-3
SUBJECT AREA (S):	Language
INSTRUCTIONAL MODE:	
SOUND	Yes, but not essential

DESCRIPTION:	The program is designed for beginning readers, containing nine activities in each of eighteen lessons. Each is sequenced to progress from recognition to recall. Activities include: word lists, reading, phrase reading, fill-ins, questions, practice writing, see-say-spell, and writing. Independent work is fostered through tutorial guidance. Skill development occurs in: perceptual thinking, visual discrimination and memory, left to right directionality, visual tracking, syntax, vocabulary, phrase reading, recall of facts and details, comparison and contrast, analogies, sequencing, skimming and scanning, proofreading techniques, sentence structure, reading fluency and rate, cloze technique, fact and opinion and inferential comprehension.
REVIEWER COMMENTS:	The software is visually appealing, however, DAL's will require some assistance in ASL on opening and navigating the program. Some material can be unclear as to next steps.
REVIEWER DATE:	Bruce Belcher ***09/30/2001***
ADDITIONAL INFORMATION:	

Dreamweaver

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 200 I.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Macromedia
VERSION/CONTENTS:	Version: Contents: 1 CD-ROM 1 User Guide
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM
OPERATING SYSTEMS:	Power Mac Win 95, 98 & NT
COST:	$90.75 US (Excluding taxes and shipping)
PRIORITIES:	
APPROPRIATE FOR GRADES/LEVELS:	Secondary (9-12) Adult
SUBJECT AREA(S):	Primary: Intemet/WWW Secondary: Computer Science
INSTRUCTIONAL MODE:	Tool
SOUND:	No sound
DESCRIPTION:	A visual Web page layout tool, the control of an **HTML** text editor and support for Dynamic **HTML** in one package. Includes an extendable JavaScript library. Academic pricing available for those who qualify.
REVIEWER COMMENTS:	
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Ken Kurlychek *8/10/2000*
ADDITIONAL INFORMATION:	

eMindMaps

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Mindjet, LLC
VERSION/CONTENTS:	Version: 2.0 Year 2000 Contents: CD-ROM
HARDWARE REQUIREMENTS:	PC CD-ROM Sound
OPERATING SYSTEMS:	Win 95 & 98
COST:	$50. US (Excluding taxes and shipping)
PRIORITIES:	Literacy Transition
APPROPRIATE FOR GRADES/LEVELS:	Elementary (4-6) Middle (7-9)
SUBJECT AREA(S):	Primary: Instructional Tools B Graphics/Presentation Secondary: Instructional Tools B Instructional Materials Generator
INSTRUCTIONAL MODE:	Authoring System Creative Activity Demonstration/Presentation Exploratio Tool
SOUND:	Minor
DESCRIPTION:	The official Mind Mapping software. Enhances everyone's learning. Streamline and memorize information in a natural, non-linear fashion. Take notes efficiently. Prepare for classes and lectures. Create lesson plans.
REVIEWER COMMENTS:	Software is fairly intuitive. Icons also included drop-down explanations. Sound is occasionally used as background music not for instructions or narration. Has multiple applications.
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Eric Murphy 7/17/2001
ADDITIONAL INFORMATION:	

Encarta 98 Encyclopedia Deluxe

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	5
PUBLISHER:	Microsoft
VERSION/CONTENTS:	Version: 1998 Contents: 2 CD-ROMs Bonus 3rd CDCResearch Organizer
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM
OPERATING SYSTEMS:	Win 95, 98 & NT
COST: PRIORITIES:	$69.95 US (Excluding taxes and shipping) Literacy
APPROPRIATE FOR GRADES/LEVELS:	Middle (7-9) Secondary (9-12) Adult
SUBJECT AREA(S):	Primary: Reference Library
INSTRUCTIONAL MODE:	Reference
SOUND:	Minor
DESCRIPTION:	This version of Encarta Encyclopedia has more than 32,000 articles. There are more than 14,000 photos and illustrations, 150 videos and animations, and 2,300 audio clips. A new multimedia feature includes Virtual Tours which enable users to take a 360 degree view of such environments as the Space Shuttle or the Maya Ruins at Tikal. The Deluxe edition includes more than 10,000 links from articles to the latest sites on the internet. Monthly updates are available.
REVIEWER COMMENTS:	Accessibility features include Closed Captions for displaying the sound portions of audio, video or animation clips in text form ..
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Rosemary Stifter 9/16/1999
ADDITIONAL INFORMATION:	<u>Microsoft Encarta World English Dictionary 2001</u> now available on Amazon.com This CBL does not require sound for effective operation.

English Discoveries - Let's Start

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 200 I.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Linguatronics 100 Light Court Folsom, CA 95630 1-800-373-4991 fax: (425) 920-0823 info@linguatronics.com/ http://www.linguatronics.com/
VERSION/CONTENTS:	Version: 2.01 - 1998 Contents: Multimedia Interactive CD
HARDWARE REQUIREMENTS:	PC - 486 or Pentium 16 mb RAM 256 colour CD ROM 640x480 display SVGA monitor Mouse Sound Card
OPERATING SYSTEMS:	Windows 3.1, 9x
COST:	$75 US
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Level 1
SUBJECT AREA (S):	Language
INSTRUCTIONAL MODE:	
SOUND	Yes
DESCRIPTION:	Learners experience the English language through articles, live videos and animation. The program offers a broad range of topics, covered through total language immersion, beginner and advanced exercises, 3000 item vocabulary, 300 hours of learning activities, entry and exit tests.
REVIEWER COMMENTS:	Graphics are appealing. Users are required to log on using passwords. The program requires ASL assistance as most instructions are audio. The software is excellent for non-ASL speakers, and provides the opportunity for instructors to custom design lessons, and keep track of student performance records.

English Discoveries - Beginners

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Linguatronics 100 Light Court Folsom, CA 95630 1-800-373-4991 fax: (425) 920-0823 info@linguatronics.com http://www.linguatronics.com/
VERSION/CONTENTS:	Version: 2.01 - 1998 Contents: 3 set - Multimedia Interactive CD's
HARDWARE REQUIREMENTS:	PC - 486 or Pentium 16mbRAM 256 colour CD ROM 640x480 display SVGA monitor Mouse Sound Card
OPERATING SYSTEMS:	Windows 3.1, 9x
COST:	$325 US
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 1-2
SUBJECT AREA (S):	Language
INSTRUCTIONAL MODE:	
SOUND	Yes
DESCRIPTION:	Learners experience the English language through articles, live videos and animation. The program offers a broad range of topics, covered through total language immersion, beginner and advanced exercises, 3000 item vocabulary, 300 hours of learning activities, entry and exit tests.

REVIEWER COMMENTS:	Graphics are appealing. Users are required to log on using passwords. The program requires ASL assistance as most instructions are audio. The software is excellent for non-ASL speakers, and provides the opportunity for instructors to custom design lessons, and keep track of student performance records
ADDITIONAL INFORMATION:	

English Discoveries - Intermediate

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Linguatronics 100 Light Court Folsom, CA 95630 1-800-373-4991 fax: (425) 920-0823 info@linguatronics.com/ http://www.linguatronics.com/
VERSION/CONTENTS:	Version: 2.0 I - 1998 Contents: 3 set - Multimedia Interactive CD's
HARDWARE REQUIREMENTS:	PC - 486 or Pentium 16 mb RAM 256 colour CD ROM 640x480 display SVGA monitor Mouse Sound Card
OPERATING SYSTEMS:	Windows 3.1, 9x
COST:	$325 US
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 2-3
SUBJECT AREA (S):	Language
INSTRUCTIONAL MODE:	
SOUND	Yes
DESCRIPTION:	Learners experience the English language through articles, live videos and animation. The program offers a broad range of topics, covered through total language immersion, beginner and advanced exercises, 3000 item vocabulary, 300 hours of learning activities, entry and exit tests.
REVIEWER COMMENTS:	Graphics are appealing. Users are required to log on using passwords. The program requires ASL assistance as most instructions are audio. The software is excellent for non-ASL speakers, and provides the opportunity for instructors to custom design lessons, and keep track of student performance records

REVIEWER DATE:	Bruce Belcher *09/30/2001*
ADDITIONAL INFORMATION:	

English Discoveries - Advanced

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 200 I.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Linguatronics 100 Light Court Folsom, CA 95630 1-800-373-4991 fax: (425) 920-0823 I nfo@linguatronics.com/ http://www.linguatronics.com/
VERSION/CONTENTS:	Version: 2.01 - 1998 Contents: 3 set - Multimedia Interactive CD's
HARDWARE REQUIREMENTS:	PC - 486 or Pentium 16mb RAM 256 colour CD ROM 640x480 display SVGA monitor Mouse Sound Card
OPERATING SYSTEMS:	Windows 3.1, 9x
COST:	$325 US
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 3-4
SUBJECT AREA (S):	Language
INSTRUCTIONAL MODE:	
SOUND	Yes
DESCRIPTION:	Learners experience the English language through articles, live videos and animation. The program offers a broad range of topics, covered through total language immersion, beginner and advanced exercises, 3000 item vocabulary, 300 hours of learning activities, entry and exit tests.
REVIEWER COMMENTS:	Graphics are appealing. Users are required to log on using passwords. The program requires ASL assistance as most instructions are audio. The software is excellent for non-ASL speakers, and provides the opportunity for instructors to custom design lessons, and keep track of student performance records

REVIEWER DATE:	Bruce Belcher *09/30/2001*
ADDITIONAL INFORMATION:	

English Express

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	ACT Laboratory Ltd. 120 - 13571 Commerce Pkwy Richmond, B.C. V6V 2R2 1-800-980-9997 fax: (604) 278-3612 techsupport@act-labs.com/ http://www.act-labs.com/
VERSION/CONTENTS:	Version: 1995 Contents: Multimedia Interactive CD
HARDWARE REQUIREMENTS:	PC - 486 8 mb RAM 12 mb hard drive 256 colour CD ROM 640x480 display SVGA monitor Mouse Sound Card
OPERATING SYSTEMS:	Windows 3.1, 9x
COST:	$199 Cdn.
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 2-4
SUBJECT AREA (S):	Language
INSTRUCTIONAL MODE:	
SOUND	Yes, but not essential
DESCRIPTION:	This software features Canadian content in the following categories: Culture, History, Science and Nature, Social Sciences and Great Canadians. Each topic has three levels of difficulty with associated tests and assignments. Illustrations from archives and other historical sources accompany the text and make the assignments challenging and fun, requiring learners to use creativity while developing English grammar, spelling and writing skills.

REVIEWER COMMENTS:	Software is visually appealing. Users are able to navigate the program with minimal instructor assistance, however, installation "pop-up" screens are written at a level not likely to be comprehended by learners at LBS Levels 2-4
REVIEWER DATE:	Bruce Belcher 09/30/2001
ADDITIONAL INFORMATION:	

English as a Second Language for Beginners

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	3
PUBLISHER:	Arc Media 5330 Main St. Suite 210 Buffalo, NY 14221-530 1-416-410-4429 fax: 1-416-410-9651 techsupport@arcmedia.com/ http://www.arcmedia.com/
VERSION/CONTENTS:	Version: 1998 Contents: Multimedia Interactive CD
HARDWARE REQUIREMENTS:	PC - 486 16mbRAM 256 colours SVGA display CD ROM Mouse Sound Card
OPERATING SYSTEMS:	Windows 3.1, 9x
COST:	$19.99 Cdn.
PRIORITIES:	Literacy
APPROPRIA TE FOR GRADES/LEVELS:	LBS Levell
SUBJECT AREA (S):	Language
INSTRUCTIONAL MODE:	
SOUND	yes, but not essential
DESCRIPTION:	This software offers a fun and easy way to learn over 700 useful everyday words and phrases, in the following topic categories: Animals, The Calendar, The Classroom, Clothing, The Home, Numbers, Restaurants, The Supermarket, Telling Time, Transportation, Weather. Topics are creatively illustrated and packed with interesting digitalized animation.
REVIEWER COMMENTS:	Learners will require instruction in ASL on how to open and navigate parts of the program. The cursor is small and difficulty to see. Written text is also too small, although they light up when the cursor is placed over them.

REVIEWER DATE:	Bruce Belcher *09/30/2001*
ADDITIONAL INFORMATION:	

English at School and on the Job

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Pearson Learning
VERSION/CONTENTS:	Version: 2000 Contents: Student Text Teacher's Resource Manual CD-ROM
HARDWARE REQUIREMENTS: OPERATING SYSTEMS:	PC CD-ROM Windows 95 or later
COST:	$37.95 Student Text $29.95 Teacher's Resource Manual $99.95 CD-ROM US (Excluding taxes and shipping)
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	Middle (7-9) Secondary (9-12) Adult
SUBJECT AREA(S):	Primary: Secondary:
INSTRUCTIONAL MODE:	
SOUND:	
DESCRIPTION:	
REVIEWER COMMENTS:	
REVIEWER /DATE	Stephen Lemieux, Pearson Education Canada 10/30/01
ADDITIONAL INFORMATION:	

The Factory Mystery - The Power of Knowledge

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	3
PUBLISHER:	Micro-Intel Inc. 1200 Papineau Ave. Suite 301 Montreal, Que. K2K4R5 1-800-530-8789 x 234 fax: n/a webmaster@micro-intel.com/ http://www.micro-intel.com/ ISBN: 2-89401-11-3
VERSION/CONTENTS:	Version: 1997 Contents: Multimedia Interactive CD
HARDWARE REQUIREMENTS:	PC - 486 8 mb RAM 2x CD ROM 640x480 display
OPERATING SYSTEMS:	Macintosh Windows 3.1,95
COST:	$225 Cdn.
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Level 3
SUBJECT AREA (S):	Language Mathematics Life Skills
INSTRUCTIONAL MODE:	
SOUND	none
DESCRIPTION:	This software includes 140 hours of skill development exercises in sentence structure, punctuation, alphabeticalizing, using automated teller machines, arithmetic and reading comprehension. Content is covered in the context of an adventure/strategy game requiring learners to search for clues, solve a mystery, understand written instructions, synthesize information to solve problems, plan a strategy, take notes, find and interpret textual information, analyze cause and effect, draw conclusions and

REVIEWER COMMENTS:	Appeals to adult learners. User guide and instructor manual included. Learners do require significant assistance to navigate the program. Vocabulary is complex, requiring dictionary work. Installation will require instructor assistance
REVIEWER DATE:	Bruce Belcher ***09/30/2001***
ADDITIONAL INFORMATION:	

Focus on Grammar

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Longman and Exceller Software Corporation
VERSION/CONTENTS:	Version: 1996 Contents: 4 CD-ROMs, 4 Guides Four levels are available, Basic, Intermediate, High Intermediate and Advanced. Each level is on a separate CD and is priced separately.
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM
OPERATING SYSTEMS:	Macintosh System 7 & 8 Power Mac Win 95, 98, NT Win 3.1 or later
COST: PRIORITIES:	$99. US per CD-ROM (Excluding taxes and shipping) Literacy
APPROPRIATE FOR GRADES/LEVELS:	Secondary (9-12) Adult
SUBJECT AREA(S):	Primary: Language Arts Secondary:
INSTRUCTIONAL MODE:	Drill and Practice Guided Practice Limited English Proficient
SOUND:	Minor
DESCRIPTION:	The Focus on Grammar series of computer software programs was created for English as Second Language learners to provide extensive grammar practice through a variety of reading, writing, and listening activities.
REVIEWER COMMENTS:	There is a listening component, but that is the only section with sound. Valuable for grammar practice after a concept has been presented by the teacher or to assess strengths and weaknesses. Well organized into specific grammar topics. You can select topics independently for study and practice as needed. Each concept has a variety of interactive activities that build on each other and progressively get more challenging Students are given feedback and help when they make mistakes Each student can create a workbook file on the computer that keeps detailed records of their scores, although these cannot be printed Few graphics - not very visually appealing. Students must navigate the hard drive of the computer or the network in order to save and find their files.

REVIEWER DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Joyce Barrett 3/20/2000
ADDITIONAL INFORMATION:	

Government Services Awareness Project

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Digital Language Works Corporation Box 20201 1395 Lawrence Ave. W. Toronto, Ont. M6L3C8
VERSION/CONTENTS:	1998 Interactive Multimedia CD
HARDWARE REQUIREMENTS:	Pentium - 166 MHz QuickTime 4 32 MB RAM 8 x CDROM 800 x 600 display 32,000 colours
OPERATING SYSTEMS:	Macintosh Windows 95, 98, NT
COST:	Free
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 1-5
SUBJECT AREA (S):	Reference
INSTRUCTIONAL MODE:	
SOUND	none
DESCRIPTION:	Provides information about 3 levels of government in plain language, with hyperlinks to departmental websites. Also includes ASL videos with English translations
REVIEWER COMMENTS:	Some assistance in ASL is required to open and navigate the program. Levels 2 and 3 learners found the virtual classroom to be beneficial.
REVIEWER DATE:	Bruce Belcher 09/30/2001
ADDITIONAL INFORMATION:	

How Multimedia Computers Work

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	QUE Corp. Macmillan USA 201 West 103rd St. Indianapolis, IN 46290-1097 (800) 858-7674 www.mcp.com/que/
VERSION/CONTENTS:	Version: 3 - 1998 Interactive Multimedia CD & printed booklet
HARDWARE REQUIREMENTS:	486 16 MB RAM CD ROM 640 x 480 display 16 bit colours Mouse
OPERATING SYSTEMS:	Macintosh Windows 3.1, 9x, NT
COST:	$45.99 Cdn.
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 1-5
SUBJECT AREA (S):	Computer Skills
INSTRUCTIONAL MODE:	
SOUND	yes
DESCRIPTION:	Computers are explained in a simple, easy to understand fashion. Illustrations and animation are colourful and memorable. This program helps learners feel more comfortable using computers.
REVIEWER COMMENTS:	Graphics are 3 dimensional, diagrams are clearly labelled. Textual information is minimal. Browsing the program is easy, as each section displays an index, maps, tours and a help file. This software can be used to good effect with learners of varying cultural backgrounds. Learners are able to tailor program use to suit their level of interest and sophistication. However, not all of the depth can be explored due to auditory instructions. Installation of the software was also easy.

REVIEWER DATE:	Bruce Belcher 09/30/2001
ADDITIONAL INFORMATION:	

HyperSign

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 200 I.

RATING: 1-Poor to 5-Excellent	5
PUBLISHER:	Trinity Software
VERSION/CONTENTS:	Version: 1997 Contents: 1 CD-ROM 1 installation diskette
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM
OPERATING SYSTEMS:	Power Mac Win 95
COST: PRIORITIES:	$95. US (Excluding taxes and shipping) Literacy
APPROPRIATE FOR GRADES/LEVELS:	Primary(1-3) Elementary (4-6) Middle (7-9) Secondary (9-12) Adult
SUBJECT AREA(S):	Primary: Sign Language Secondary: Language Arts
INSTRUCTIONAL MODE:	Demonstration/Presentation Drill and Practice Education Game
SOUND:	Minor
DESCRIPTION:	ASL Dictionary of more than 2000 words searchable by name, category or scrolling. Has full motion video representing each word. The dictionary can be set for a child, teen or adult. The text can be set in English or in Spanish.
REVIEWER COMMENTS:	The Children's dictionary is highly visual. It is designed for non-readers or early readers; each word is accompanied by a Picture Communication Symbol (PCS) symbol. Adult activities included.
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center	Rosemary Stifter 9/16/1999
ADDITIONAL INFORMATION:	

Insects

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	ICE - Integrated Communications and Entertainment Inc. 489 Queen St. E. Toronto, Ont. M5A IVI 1-416-868-6423 fax: (416) 367-8996 http://www.juniorguides.com/
VERSION/CONTENTS:	Version: 2.03 -1997 Contents: Multimedia Interactive CD
HARDWARE REQUIREMENTS:	8MBRAM 12 MB hard drive space High Speed CD ROM SVGA monitor 256 colour
OPERATING SYSTEMS:	Windows 3.1, 95
COST:	$29.99 US
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 1-3
SUBJECT AREA (S):	Reference
INSTRUCTIONAL MODE:	
SOUND	none
DESCRIPTION:	This software contains 3-D activities that highlight information about insects, including a Field Kit. Contents include: Found Almost Everywhere, Meadows, Fields and Grasslands, Woodlands, Deserts and Savanna, Rivers, Lakes and Bogs, Pests and Parasites. Listings of web sites, organizations and reference materials for further information are also provided.
REVIEWER COMMENTS:	Learners find the information fascinating. ASL assistance is required on opening and navigating the program. This software provided opportunities for learners to improve spelling and vocabulary skills. Pictures are very rich in colour. The virtual classroom feature was very helpful.
REVIEWER DATE:	Bruce Belcher 09/30/2001
ADDITIONAL INFORMATION:	

Inspiration

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	5
PUBLISHER:	Inspiration Software, Inc.
VERSION/CONTENTS:	Version: 5.0e/l999 Contents: 2 CD-ROMs (1 is a tutorial) I User Guide I book, "Classroom Ideas Using Inspiration for Teachers by Teachers"
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM
OPERATING SYSTEMS:	Win 95, 98, NT
COST: PRIORITIES:	$57.95 US (Excluding taxes and shipping Literacy
APPROPRIATE FOR GRADES/LEVELS:	Primary(1-3) Elementary (4-6) Middle (7-9) Secondary (9-12) Adult
SUBJECT AREA(S):	Primary: Language Arts Secondary: Cross Curricular
INSTRUCTIONAL MODE:	Creative Activity Problem Solving Tool
SOUND:	No sound
DESCRIPTION:	Easy-to-use tool for concept mapping, webbing and outlining. Use the Diagram view to dynamically create and modify concept maps and webs. Use the Outline view to organize writing and science assignments. Teachers can create lesson plans and tests.
REVIEWER COMMENTS:	This is a very good program for use by an individual or group who need to plan something. It could be used for storyboarding, web site design, flow-charting. The idea book is worthwhile.
REVIEWER /DATE Review originally submitted to Laurent Clerc National Deaf Education Center)	Ken Kurlychek 9/14/1999
ADDITIONAL INFORMATION:	Requires use of a sound card and has quite a bit of audio information

Interactive Picture Dictionary for Windows

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Protea Textware Ltd. Grass Roots Press P.O. Box 52192 Edmonton, Alberta. T6G *2T5* 1-888-303-3213 fax: (780) 413-6582 grassrt@telusplanet.net/ http://www.literacyservices.com/
VERSION/CONTENTS:	Version: 2.0 - 1996 Contents: Multimedia Interactive CD
HARDWARE REQUIREMENTS:	486 - 33 MHz 8MBRAM 7 MB hard disk space CD ROM 256 colour Mouse Sound Card
OPERATING SYSTEMS:	MS DOS 3.1 Windows 3.1
COST:	$135.00 Cdn.
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 1-2
SUBJECT AREA (S):	English Reference
INSTRUCTIONAL MODE:	
SOUND	yes, but not essential
DESCRIPTION:	This program has 7 main themes: the house, places, nature, foods, materials, people and verbs and contains over 800 words. Each theme contains 40 topics that help teach and test singular and plural spellings. For each word, learners will see a photo, observe the word used **in** context, and perform spelling activities, such as typing in missing letters, typing from memory and using the word in context. Tests of vocabulary recognition are included for each topic. Teachers can add their own word lists and the program will create exercises for filling in missing letters.

REVIEWER COMMENTS:	Navigation of the program is easy for learners, requiring minimal assistance. Learners with visual challenges will have difficulty distinguishing some colours.
REVIEWER DATE:	Bruce Belcher *09/30/2001*
ADDITIONAL INFORMATION:	

Learn About Earth Science: Weather

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Sunburst
VERSION/CONTENTS:	Version: 2001 Contents CD-ROM
HARDWARE REQUIREMENTS:	PC Macinto CD- Sound Card
OPERATING SYSTEMS:	Power Mac Win 95
COST:	$89.95 US (Excluding taxes and shipping
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	Primary(1-3) Elementary (4-6) Middle (7-9)
SUBJECT AREA(S):	Primary: Science B Earth Science Secondary: Cross Curricular
INSTRUCTIONAL MODE:	Demonstration/Presentation Education Game Exploration Guided Practice
SOUND:	Minor
DESCRIPTION:	This product contains lessons about weather. There are fun activities to support the lessons and review and assessment quizzes. Students can print a certificate acknowledging lessons completed. There is a word processor allowing students to take notes or write stories/reports. All text is presented on screen except the introduction. All lesson content is accessible in print and all feedback is visual. There is one support section, a jukebox, that depends on auditory access.
REVIEWER COMMENTS:	This product is written very well and is visually pleasing. The content is accessible in print and all feedback is visual. This is a very valuable educational resource and would be a wonderful
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Shelley Popson 10/26/2001
ADDITIONAL INFORMATION:	

Learn About Life Science: The Senses

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Sunburst
VERSION/CONTENTS:	Version: 2001 Contents CD-ROM, Book
HARDWARE REQUIREMENTS:	PC Macinto CD- Sound Card
OPERATING SYSTEMS:	Power Mac Win 95
COST: PRIORITIES:	$89.95 US (Excluding taxes and shipping) Literacy
APPROPRIATE FOR GRADES/LEVELS:	Primary (1-3) Elementary (4-6) Middle (7-9)
SUBJECT AREA(S):	Primary: Cross Curricular Secondary: Science B Biology
INSTRUCTIONAL MODE:	Demonstration/Presentation Education Game Guided Practice
SOUND:	Minor
DESCRIPTION:	This product contains a "Senses Book" with nine lessons about the senses. All information (other than the introduction) has text presentation. There are fun quizzes to provide review and assessment. All feedback is visual in addition to being auditory. Certificates can be printed to acknowledge the completion of each lesson. Word processing is built into the package for note taking, story or report writing. There are other activities to support learning. There is an activity or two (out of MANY) that require hearing to participate. These activities are supplemental to the content.
REVIEWER COMMENTS:	All text is easy to read, very well written in clear vocabulary. Visually pleasing program with all visual feedback during activities. Includes content that all primary learners are required to learn
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Shelley Popson 10/26/2001
ADDITIONAL INFORMATION:	

Life and Times of the Prime Ministers

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	McClelland & Stewart 481 University Ave. Suite 900 Toronto, Ont. M5G 2E9 (416)598-1114 fax: (416) 598-7764 salesdept@mcclelland.com/ www.mcclelland.com/
VERSION/CONTENTS:	1998 Interactive Multimedia CD
HARDWARE REQUIREMENTS:	486- 66 MHz 16MBRAM 5 MB hard drive space QuickTime 2.1.2 CD ROM 640 x 480 display 16 bit colour
OPERATING SYSTEMS:	Windows 3.1, 9x, NT
COST:	$39.95 Cdn.
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 1-5
SUBJECT AREA (S):	Reference
INSTRUCTIONAL MODE:	
SOUND	yes, but not essential
DESCRIPTION:	Includes specially produced interviews with all of the living Prime Ministers, film and audio clips from archival sources, and commentary by leading historians.
REVIEWER COMMENTS:	Clear and easy to follow instructions assist with browsing the program. Learners can independently explore the depth they require. This program was especially valued by deaf learners preparing for citizenship.
REVIEWER DATE:	Bruce Belcher 09/30/2001
ADDITIONAL INFORMATION:	

Longman Dictionary of Contemporary English

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Pearson Education Ltd. 5757 Rue Cypihot Saint-Laurent, Que. H4S IR3 1-800-263-3678 fax: (800) 643-4720 erpi-esl@erpi.com/ http://www.longman.com/
VERSION/CONTENTS:	Version: 1997 Contents: Multimedia Interactive CD
HARDWARE REQUIREMENTS:	486 - 66 MHz 16 MB RAM 4xCDROM 16 bit colour Mouse 640x 480 display
OPERATING SYSTEMS:	Macintosh Windows 9x, NT
COST:	$39.95 Cdn.
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 2-4
SUBJECT AREA (S):	Reference
INSTRUCTIONAL MODE:	
SOUND	none
DESCRIPTION:	Containing 84,000 words and phrases, the CD features: definitions, natural examples and 5000 illustrations.
REVIEWER COMMENTS:	Primarily designed for hearing ESL learners, this program still has some useful features for deaf learners.
REVIEWER DATE:	Bruce Belcher 09/30/2001
ADDITIONAL INFORMATION:	

Math Arena

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	5
PUBLISHER:	Houghton Mifflin Interactive
VERSION/CONTENTS:	Version: 1999 Contents: Teachers Guide and CD-ROM
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM
OPERATING SYSTEMS:	Macintosh System 7 & 8 Power Mac Win 95 & 98
COST:	$0.00 US (Excluding taxes and shipping)
PRIORITIES:	
APPROPRIATE FOR GRADES/LEVELS:	Elementary (4-6) Middle (7-9)
SUBJECT AREA(S):	Primary: Math B Advanced Math Secondary:
INSTRUCTIONAL MODE:	Demonstration/Presentation Drill and Practice Education Game Guided Practice Problem Solving
SOUND:	No sound
DESCRIPTION:	Students train for "Math Events" in Geometry, Statistics, Arithmetic Computation, Graphing, Arrays, Percent, Money, Measurement, Representations and use of Venn Diagrams. Students have options to either Train or Compete. Levels are 'easy' and 'hard'. A chart in the Teacher's Guide lists the NCTM Standards and correlating units.
REVIEWER COMMENTS:	I love this software and plan to use it in my classes. There is a training component as well as practice (competition) with the added bonus that it is fun. A wide variety of math skills and concepts are covered. making it an excellent buy! The Teacher's Guide is an excellent resource.
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Barbara Fields 8/22/2001
ADDITIONAL INFORMATION:	

Math Mysteries: Whole Numbers

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Tom Snyder Productions
VERSION/CONTENTS:	Version: May 3, 1992 Contents: CDs, individual or small group and a class CD Reproducibles: worksheets and teacher helps. Documentation of how to use.
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM Sound Card
OPERATING SYSTEMS:	Macintosh System & Win 95 & 98
COST:	$79.95 US (Excluding taxes and shipping)
PRIORITIES:	Literacy Transition
APPROPRIATE FOR GRADES/LEVELS:	Elementary (4-6) Middle (7-9)
SUBJECT AREA(S):	Primary: Math B Numbers Secondary: Language Arts
INSTRUCTIONAL MODE:	Demonstration/Presentation Education Game Exploration Guided Practice Problem Solving Tutorial
SOUND:	Moderate
DESCRIPTION:	Read each character's story in order to solve a mystery by finding the answer to given problems using reasoning and mathematical computation. A simulated cruise has characters assuming roles and responsibilities for a particular item. Participants are given certain rules and must use their computation skills to solve each character's part in the mystery.
REVIEWER COMMENTS:	Captioning benefits deaf students. The program is quite colorful and has animation. It's a great opportunity for a pair, or small group to use their group problem solving skills. Students have an opportunity to review, choose, calculate and justify their answers. After calculations are made, the program lets the student know if the calculations are correct. Additional worksheets may have to be made that will assist the record keeping process.
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Margaret Simpson 9/8/2000
ADDITIONAL INFORMATION:	

Mavis Beacon Teaches Typing 9: Teacher's Edition

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	The Learning Company
VERSION/CONTENTS:	Version: 9.0/1998 Contents: I CD with Teacher's Guide & Resource Package in a binder
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM Sound Card
OPERATING SYSTEMS:	Macintosh System 7 & 8 Power Mac Win 95, 98, NT
COST:	$30. US (Excluding taxes and shipping)
PRIORITIES:	Transition
APPROPRIATE FOR GRADES/LEVELS:	Middle (7-9) Secondary (9-12) Adult
SUBJECT AREA(S):	Primary: Keyboarding Secondary: -
INSTRUCTIONAL MODE:	Drill and Practice Guided Practice
SOUND:	Moderate
DESCRIPTION:	Mavis Beacon teaches the correct hand and finger positioning and posture for typing as well as providing instruction on basic and more advanced keyboarding skills. It also provides drill and practice for keyboarding.
REVIEWER COMMENTS:	This is a good program for upper middle school and older students to learn keyboarding skills. This version 9 includes movies which are not captioned and some introductory voice only information.
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Joyce Barrett 8/6/2001
ADDITIONAL INFORMATION:	

MP Express

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	5
PUBLISHER:	Bytes of Learning Incorporated
VERSION/CONTENTS:	Version: 1,2 lb Contents: 1 CD-ROM 1 User Guide
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM
OPERATING SYSTEMS:	Macintosh System Win 95, 98 & NT
COST: PRIORITIES:	$0.00 US (Excluding taxes and shipping) Literacy Family Education
APPROPRIATE FOR GRADES/LEVELS:	Primary(1-3) Elementary (4-6) Middle (7-9) Secondary (9-12) Adult
SUBJECT AREA(S):	Primary: Instructional Tools B Graphics/Presentation Secondary: Instructional Tools B Graphics/Presentation
INSTRUCTIONAL MODE:	Creative Activity Demonstration/Presentation Multimedia Simulation Tool
SOUND:	Major
DESCRIPTION:	Similar to PowerPoint, allows development of multimedia presentations.
REVIEWER COMMENTS:	It is strongly recommend that other CD-Roms be used as resources.
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Debbie Burnaman 7/19/2001
ADDITIONAL INFORMATION:	

Oxford Picture Dictionary

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Oxford University Press
VERSION/CONTENTS:	Version: 2000 Contents: 1 quality of CD-ROM
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM Sound Card
OPERATING SYSTEMS:	Macintosh System 7 Power Mac Win 95
COST: PRIORITIES:	$149. US (Excluding taxes and shipping) Literacy
APPROPRIATE FOR GRADES/LEVELS:	Middle (7-9) Secondary (9-12) Adult
SUBJECT AREA(S): INSTRUCTIONAL MODE:	Primary: Language Arts Secondary: Reference Library Drill and Practice Limited English Proficient Multimedia Reference Tutorial
SOUND:	Moderate
DESCRIPTION:	The CD-ROM consists of all 3,700 words and colorful illustrations of the Oxford Picture Dictionary for beginners and intermediate learners. They include Readings, Dictations, Dialogs, Role-plays and Writing activities. Also, they offer games and a teacher management system to review and edit student information.
REVIEWER COMMENTS:	Interesting with colorful illustrations.
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	John Gibson, ESL Teacher 12/20/2000
ADDITIONAL INFORMATION:	

Postcards

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Curriculum Associates Inc.
VERSION/CONTENTS:	Version: 1996 Contents: CD-ROM, User Guide Installation Instructions Instructor Guide Reproducibles
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM
OPERATING SYSTEMS:	Macintosh System 7 & 8 Power Mac Win 95, 98, NT & 3.1
COST:	$99. US (Excluding taxes and shipping)
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	Elementary (4-6) Middle (7-9)
SUBJECT AREA(S):	Primary: Language Arts Secondary: Language Arts
INSTRUCTIONAL MODE:	Exploration Multimedia
SOUND:	Minor
DESCRIPTION:	Postcards is a writing program that teaches the skills needed to tackle the most difficult aspects of writing; planning and drafting. Students plan and draft postcards based on the four fundamental text structures: narrative, compare/contrast, descriptive, and persuasive.
REVIEWER COMMENTS:	This is a fun way to learn to write in general. Students choose either a filmmaker, archaeologist, author or investigator as a companion and can choose to visit Ghana, Mexico or Japan.
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Jeanne Karlecke 7/17/2001
ADDITIONAL INFORMATION:	

Print Shop Deluxe

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 200 I.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	The Learning Co. Broderbund Software 6493 Kaiser Dr. Fremont, CA 94555 (510) 792-2101 fax: (510) 713-6072 support@learningco.com/ www.printshop.com/
VERSION/CONTENTS:	Version: 10 - 1999 Interactive Multimedia CD
HARDWARE REQUIREMENTS:	Pentium - 133 MHz 32 MB RAM 4x CD ROM 800 x 600 display
OPERATING SYSTEMS:	Macintosh Windows 95, 98, NT
COST:	$75 Cdn.
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 1-5
SUBJECT AREA (S):	Reference
INSTRUCTIONAL MODE:	
SOUND	none
DESCRIPTION:	A very complete and effective desktop publishing tool, this program allows learners to create business letters, newsletters, business cards, personal greetings and photo albums by including pre-designed templates and many text and image tools which can be personalized by learners.
REVIEWER COMMENTS:	Fairly extensive exploration of the features is recommended before learners begin to use the program, as it comes with 10 CD's which must be inserted at a prompt. Learners with employment goals found this software beneficial
REVIEWER DATE:	Bruce Belcher 09/30/2001
ADDITIONAL INFORMATION:	

Resume Maker with Career Planning

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Individual Software Inc. 4255 Hopyard Rd. Unit #2 Pleasanton, CA 94588 (800) 822-3522 fax: (925) 734-6031 orders@individualsoftware.com/ www.individualsoftware.com/
VERSION/CONTENTS:	Version: 6 Interactive Multimedia CD
HARDWARE REQUIREMENTS:	486 DX/33 8MBRAM CD ROM 30 MB free disk space SVGA card 256 colours Sound card Mouse Internet Access
OPERATING SYSTEMS:	Windows 9x
COST:	$28 US
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 3-5
SUBJECT AREA (S):	Employability
INSTRUCTIONAL MODE:	
SOUND	yes
DESCRIPTION:	This package guides learners through the process of locating and applying for jobs, including 25 resume designs and tips on interviewing. The Career Planning component teaches organization in the job search, encouraging research and tracking of activities. The Guided Resumes component provides a fill-in-the-blanks template with thousands of key words. The Career Counselor feature provides information on 12,700 different job types.

REVIEWER COMMENTS:	The Virtual Interview component was auditory and not useful to deaf learners. Use of the program without personal instruction on employability is not recommended. The software is easy to install and the help application is beneficial.
REVIEWER DATE:	Bruce Belcher *09/30/2001*
ADDITIONAL INFORMATION:	

Show Me Math

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Attainment Co. P.O. Box 930160 Verona, WI 53593-0160 1-800-327-4269 fax: 1-800-942-3865 info@attainmentcompany.com http://www.attainmentcompany.com/
VERSION/CONTENTS:	Version: 2.04 -1999 Contents: Multimedia Interactive CD
HARDWARE REQUIREMENTS:	PC Sound Card
OPERATING SYSTEMS:	Macintosh Windows 9x
COST:	$99.00 Cdn.
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 1-2
SUBJECT AREA (S):	Mathematics
INSTRUCTIONAL MODE:	
SOUND	yes, but not essential
DESCRIPTION:	This software focuses on addition, subtraction, multiplication and division, using exercises, short animated movies and quizzes.
REVIEWER COMMENTS:	Very visually appealing. Learners are able to explore the software without assistance, although some vocabulary help may be required. Learners can work at their own pace. When errors are made, explanation windows pop-up. Changing colours can sometimes be confusing.
REVIEWER DATE:	Bruce Belcher 09/30/2001
ADDITIONAL INFORMATION:	

Show Me Spelling

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	5
PUBLISHER:	Attainment Co. P.O. Box 930160 Verona, WI 53593-0160 1-800-327-4269 fax: 1-800-942-3865 info@attainmentcompany.com http://www.attainmentcompany.com/
VERSION/CONTENTS:	Version: 2.03 -1999 Contents: Multimedia Interactive CD
HARDWARE REQUIREMENTS:	PC Sound Card DirectX drivers
OPERATING SYSTEMS:	Macintosh Windows 95
COST:	$129 Cdn.
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 1-2
SUBJECT AREA (S):	Language
INSTRUCTIONAL MODE:	
SOUND	yes, but not essential
DESCRIPTION:	This software allows learners to learn over 500 words. Exercises include: letters, scrolling alphabet, selecting word lists and creating word lists. Quizzes provide results and opportunities to recap incorrectly spelled words. Pictures assist with memorization skills.
REVIEWER COMMENTS:	Some graphics are difficult to interpret due to size, font, colour or texture. Learners can easily install, navigate and exit the program. Instructional screens are easy to comprehend.
REVIEWER DATE:	Bruce Belcher 09/30/2001
ADDITIONAL INFORMATION:	

Sim City 3000

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Maxis
VERSION/CONTENTS:	Version: 2000 Contents: CD-ROM
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM
OPERATING SYSTEMS:	Power Mac Win 95, 98 & NT
COST:	$19.95 US (Excluding taxes and shipping)
PRIORITIES:	
APPROPRIATE FOR GRADES/LEVELS:	Middle (7-9) Secondary (9-12) Adult
SUBJECT AREA(S):	Primary: Social Studies Secondary: Problem Solving/Logic
INSTRUCTIONAL MODE:	Education Game Problem Solving Simulation
SOUND:	Minor
DESCRIPTION:	Serving as Mayor, users must create a city that provides a good life for the Sims (little folks that live in the little SimCities within the SimNation). They get to build the city from scratch, manage the budget, the taxes and then see what impact their decisions have on people in the city as the community progresses.
REVIEWER COMMENTS:	Highly motivating activity for students to learn vocabulary and concepts about city management, government, and the environmental impact of various decisions. It works well as a team activity also.
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Joyce Barrett 8/7/2001
ADDITIONAL INFORMATION:	

Skills Enhancer

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	5
PUBLISHER:	Communication Service for the Deaf http://www.c-s-d.org/
VERSION/CONTENTS:	Version: 1999 Contents: 1 CD-ROM
HARDWARE REQUIREMENTS: OPERATING SYSTEMS:	PC Win 95, 98
COST:	$0.00 US (Excluding taxes and shipping)
PRIORITIES:	Literacy Family Education Transition
APPROPRIATE FOR GRADES/LEVELS:	Secondary (9-12) Adult
SUBJECT AREA(S):	Primary: Language Arts Secondary: Problem Solving/Logic
INSTRUCTIONAL MODE:	Guided Practice Multimedia Problem Solving Tutorial
SOUND:	No sound
DESCRIPTION:	The tutorial curriculum is intended to help learners practice and build skills in math, reading, writing and grammar. Mastery of these skills is essential for succeeding in postsecondary and employment settings. The CD-ROM contains some descriptions in ASL.
REVIEWER COMMENTS:	Each of the four sections begins with simple concepts and builds up to more complex tasks and ends with a quiz that tests the skills the user has learned. "Lee's Paycheck" section encourages math problem solving. One can discover how math skills are important in solving everyday problems. The Reading section uses Aesop's Fables to teach reading comprehension and vocabulary. I wish the fables could be explained in ASL instead just a limited number of vocabulary words. The writing section has a very interactive lesson on how to write business letters, friendly letters and resumes. The grammar section has a solid progression to teaching sentence structure but there is a lot of English text with little or no ASL support The design is simple and straightforward. The graphics and animations are good.
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Rosemary Stifter 2/23/2001

ADDITIONAL INFORMATION:	The CSD of Minnesota developed this CD-ROM specifically for developing math, reading, writing and grammar skills in adult learners who are deaf or hearing impaired. Go to: http://www.c-s-d.org/

Student Writing and Research Centre & Compton's Concise Encyclopedia

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	The Learning Co. 6493 Kaiser Dr. Fremont, CA 94555 (800) 395-0277 fax: (510) 713-6072 support@learningco.com/ www.learningco.com/
VERSION/CONTENTS:	Version: 1.0-1995 Interactive Multimedia CD
HARDWARE REQUIREMENTS:	486 16MB RAM CD ROM SVGA display 256 colours Sound Card
OPERATING SYSTEMS:	Windows 3.1, 9x
COST:	$19.95 US
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 2-3
SUBJECT AREA (S):	Language Reference
INSTRUCTIONAL MODE:	
SOUND	yes, but not essential
DESCRIPTION:	The program combines word processing and research skills. It includes a 25 volume encyclopedia, bibliography maker, thesaurus, spell check feature and five different document types, including: reports, newsletters, journals, signs and letters.

REVIEWER COMMENTS:	This software was fun for students to use. Some pre-exploration was worthwhile so that learners had a sense of the full range of features before starting to work. The test group found the journal and newsletter components particularly good for development grammar skills. Students could not, however, install this software themselves.
REVIEWER DATE:	Bruce Belcher *09/30/2001*
ADDITIONAL INFORMATION:	

Talking Walls

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001

RATING: 1-Poor to 5-Excellent	5
PUBLISHER:	Edmark www.edmark.com/
VERSION/CONTENTS:	Version: School Version, 1.0 Contents: It includes the book "Talking Walls," 2 CD's, a software manual and a teacher's manual with suggestions for curriculum integration.
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM Sound Card
OPERATING SYSTEMS:	Macintosh System 7 Win 95
COST:	$79.95 US (Excluding taxes and shipping)
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	Elementary (4-6) Middle (7-9) Secondary (9-12)
SUBJECT AREA(S):	Primary: Social Studies Secondary: Language Arts
INSTRUCTIONAL MODE:	Exploration Multimedia Reference
SOUND:	Minor
DESCRIPTION:	This is a multimedia program that allows students to explore the stories behind some of the world's most fascinating walls and learn how these structures have influenced cultures and societies. It is based on the book "Talking Walls" and includes literature, videos, activities, links to websites, and very in-depth information.
REVIEWER COMMENTS:	This is a beautiful program that is very engaging and educational. It offers the user the ability to listen to the text read aloud, but it is not necessary to use this feature.
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Susan Bigman 7/17/2001
ADDITIONAL INFORMATION:	Edmark is the creator of educational software aimed at the pre-school to early teen market. www.edmark.com/

Timeliner 4.0

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Tom Snyder Productions http://www.tomsnyder.com/
VERSION/CONTENTS:	Version: 4.0 Contents: TimeLiner 4.0 includes the TimeLiner 4.0 software application, a comprehensive Teacher's Guide, and an Activities Guide with lesson plans and reproducible worksheets, and a set of sampler time lines. Program disk and back up license, sample time lines, teacher's Guide, lesson plans, worksheets, all in a sturdy vinyl binder.
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM
OPERATING SYSTEMS:	Macintosh System 7 & 8 Power Mac Win 95 & 98
COST:	$79.95 US (Excluding taxes and shipping)
PRIORITIES:	Literacy Family Education Transition
APPROPRIATE FOR GRADES/LEVELS:	Primary (1-3) Elementary (4-6) Middle (7-9) Secondary (9-12) Adult
SUBJECT AREA(S):	Primary: Social Studies Secondary: Science B General Sciences
INSTRUCTIONAL MODE:	Drill and Practice
SOUND:	No sound
DESCRIPTION:	TimeLiner 4.0 makes it easy to create, illustrate, and print time lines. Simply enter events and dates, and TimeLiner 4.0 organizes the events into chronological order. Print your time lines in any size to display student work and decorate your classroom. It represents and prints information in multiple forms: banners, single-page time lines, and lists Customize fonts, sizes, styles, and colors Add titles to any time line Import graphics
REVIEWER COMMENTS:	This software has to be learned by the teacher before the students can utilize it. The manual "Walk Through" section takes a long time to get through. The manual directions are not clear.
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Becky Jo Cline 8/2/2001

ADDITIONAL INFORMATION:	Timeliner 5.0 is now available from Tom Snyder Productions at $79.95 US. http://www.tomsnyder.com

Typing Tutor: Learning to Type for Today's Internet World

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Kortex Computer 2220 Superior Blvd. Mississauga, Ont. L5T 2L2 (888) 567-8391 fax: na istojic@kortexcomputer.com www.kortexcomputer.com/
VERSION/CONTENTS:	Version: 1999 Interactive Multimedia CD
HARDWARE REQUIREMENTS:	Pentium 90 32MB RAM CD ROM 640 x 480 display 256 colours SVGA graphics card Mouse
OPERATING SYSTEMS:	Macintosh Windows
COST:	$35 Cdn.
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 1-5
SUBJECT AREA (S):	Computer Skills
INSTRUCTIONAL MODE:	
SOUND	yes
DESCRIPTION:	This program is intended to introduce and familiarize learners with keyboarding, emails and internet web pages, without being on-line. Lessons are customized to each learners' skill level. It includes 8 action games to increase speed and accuracy.
REVIEWER COMMENTS:	Learners are challenged to set a goal in typing words per minute. Instruction in ASL is required before working on assignments. Auditory instructions restrict full use of the program.

REVIEWER DATE:	Bruce Belcher *09/30/2001*
ADDITIONAL INFORMATION:	

Virtual Labs: Electricity

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	5
PUBLISHER:	Edmark www.edmark.com/
VERSION/CONTENTS:	Version: 1.0 Contents: A notebook is included with the software which includes directions, reproducible sheets for over 40 lab experiments, and information for product support, etc.
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM Sound Card
OPERATING SYSTEMS:	Macintosh System 7 Win 95 & 98
COST:	$0.00 US (Excluding taxes and shipping)
PRIORITIES:	
APPROPRIATE FOR GRADES/LEVELS:	Middle (7-9) Secondary (9-12)
SUBJECT AREA(S):	Primary: Science B General Sciences Secondary: Science B Scientific Method/Lab Equipment
INSTRUCTIONAL MODE:	Creative Activity Exploration Problem Solving Reference Simulation
SOUND:	Minor
DESCRIPTION:	Virtual Labs: Electricity combines ready-to-use experiments and simulations with 40+ reproducible lab worksheets. Students learn basic to advanced topics in electricity, including the following: series and parallel circuits; conductors and resistors; voltage and current; the physics of electricity; logic; and electrical safety. This program can be used with physical science curricula, as well as application of the scientific method. Some reference material is also included.
REVIEWER COMMENTS:	The program takes a little bit of time to get used to, but is excellent once users figure their way around. The program is very interactive, containing a number of good experiments
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Jana Lollis 7/31/2001
ADDITIONAL INFORMATION:	Edmark is the creator of educational software aimed at the pre-school to early teen market. www.edmark.com/

Vocabulary

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Super Tutor Company http://smartkindssoftware.com/
VERSION/CONTENTS:	Version: 1998 Contents
HARDWARE REQUIREMENTS:	PC CD-
OPERATING SYSTEMS:	Windows 95 or later
COST:	$29.95 US (Excluding taxes and shipping)
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	Secondary (9-12) Adult
SUBJECT AREA(S):	Primary: Vocabulary Secondary: Spelling
INSTRUCTIONAL MODE:	
SOUND:	Minor
DESCRIPTION:	Includes 75 word lists for practice purposes. Includes both visual and auditory prompts. Many interactive quizzes and exercises
REVIEWER COMMENTS:	Excellent reviews of spelling, tense and punctuation. Appropriate for ESL students as well.
REVIEWER /DATE	VP 10/20/01
ADDITIONAL INFORMATION:	This title is in the collection of Mohawk College Library. It has the LC call number PE 1449.V62 1998 and is available to Deaf Empowerment students/instructors. More Super Tutor titles available at http://smartkindssoftware.com/

What Colour is Your Parachute

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001

RATING: 1-Poor to 5-Excellent	3
PUBLISHER:	Bumblebee Technologies 50 Congress St. Boston, MA 02109 (617) 263-1100 fax: (617) 227-6720 sales@parachute.net/ www.parachute.net/
VERSION/CONTENTS:	Version: Interactive Multimedia CD
HARDWARE REQUIREMENTS:	Pentium 16MB RAM 640 x 480 display CD ROM 16 bit colours Mouse
OPERATING SYSTEMS:	Windows 9x, NT
COST:	$49.95 US
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	LBS Levels 3-5
SUBJECT AREA (S):	Employability
INSTRUCTIONAL MODE:	
SOUND	yes, but not essential
DESCRIPTION:	This package is very comprehensive and detailed in assessing learners skills, knowledge and goals. Templates and hands on activities are clear. Video instructions guide users through the process of finding what career is best for each individual.
REVIEWER COMMENTS:	An excellent resource, easily navigated across many different sections. Use of the program is greatly enhanced with an employability instructor in the classroom to provide additional activities to replace information contained in auditory portions.
REVIEWER DATE:	Bruce Belcher 09/30/2001
ADDITIONAL INFORMATION:	

World Political Leaders

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	ABC-CLIO http://www.abc-clio.com/
VERSION/CONTENTS:	Version: --- Contents: CD-ROM and informational brochure/enclosure
HARDWARE REQUIREMENTS: OPERATING SYSTEMS:	PC CD-ROM Win 95, 98 & NT
COST:	$0.00 US (Excluding taxes and shipping
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	Secondary (9-12)
SUBJECT AREA(S):	Primary: Social Studies Secondary: ---
INSTRUCTIONAL MODE:	Reference
SOUND:	No sound
DESCRIPTION:	This CD-ROM includes biographical information for 600 men and women who have played significant roles in world politics during the 19th and 20th centuries. Four index and search tools provide many ways to find biographies. Included are a timeline and browsing tool as well as bookmarks and notebook tools for tagging and making notes. Students can also print and export materials for further reference and research.
REVIEWER COMMENTS:	A good quick resource on specific political leaders well organized timeline allows for quick across time periods.
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Linda McCarty 8/22/2001
ADDITIONAL INFORMATION:	World Political Leaders features 600 world leaders of the 19th and 20th centuries who have held political office, as well as seminal figures such as Karl Marx and Friedrich Engels. Biographical entries include Otto von Bismarck, Winston Churchill, Mao Zedong, Simon Bolivar, Margaret Thatcher, and Queen Victoria. A wide variety of historical reference CD-ROMs are available from ABC-CLIO from $29 to 95-$79.95 at http://www.abc-clio.com/

WOW: World of Words

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	RES Software Available at http://www.epicent.com/
VERSION/CONTENTS:	Version: 1998 Contents: CD-ROM Instruction Guide
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM
OPERATING SYSTEMS:	Windows 3.1 or higher Macintosh 7.1 or higher
COST:	$69.95 US (Excluding taxes and shipping)
PRIORITIES:	Literacy
APPROPRIATE FOR GRADES/LEVELS:	Secondary (9-12) Adult
SUBJECT AREA(S):	Primary: Vocabulary Secondary: Grammar
INSTRUCTIONAL MODE:	
SOUND:	Some
DESCRIPTION:	WOW customizes activities to meet the needs of the individual. Students can interact with material by typing, drawing, and comparing their impressions with the program's information. The program is intended to increase reading, comprehension, writing skills, and communication skills. World of Words is particularly beneficial for high school students preparing for the PSAT/SATs and the ACTs, middle school students studying for the SSATs (Secondary School Admissions Test) and people of all ages who want to increase their vocabulary knowledge through a consistent testing mechanism.
REVIEWER COMMENTS:	WOW is also recommended for such diverse populations as the gifted, English as Second Language students, and the learning disabled.
REVIEWER /DATE	Reviewed and recommended by PC Novice 1996 Described by H. Bender 10/30/2001
ADDITIONAL INFORMATION:	This title is in the collection at the Mohawk College Library under the call number PE1449.W65 1998, and available to Deaf Empowerment and English as a Second Language students and instructors.

Writer's Toolkit

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	3.5
PUBLISHER:	Pearson Learning
VERSION/CONTENTS:	Version: 2000 Contents: Student Textbook Teacher's Resource Manual CD-ROM
HARDWARE REQUIREMENTS:	PC CD-ROM
OPERATING SYSTEMS:	
COST: PRIORITIES:	$37.95 Student Textbook $29.95 Teacher's Resource Manual $99.95 CD-ROM US (Excluding taxes and shipping Literacy
APPROPRIATE FOR GRADES/LEVELS:	Middle (7-9) Secondary (9-12) Adult
SUBJECT AREA(S):	Primary: Grammar Secondary: Composition
INSTRUCTIONAL MODE:	
SOUND:	Minor
DESCRIPTION:	
REVIEWER COMMENTS:	
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Stephen Lemieux, Pearson Education Canada 10/30/01
ADDITIONAL INFORMATION:	

Writing In The Real World

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Pearson Learning Group
VERSION/CONTENTS:	Version: 2000 Contents: Real World Booklet $2.95 Teacher's Guide $8.95 Student Guide $23.50 CD-ROM $19.95
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM
OPERATING SYSTEMS:	
COST: PRIORITIES:	$19.95 US (Excluding taxes and shipping)
APPROPRIATE FOR GRADES/LEVELS:	Middle (7-9) Secondary (9-12) Adult
SUBJECT AREA(S):	Primary: Business Communication Secondary:
INSTRUCTIONAL MODE:	
SOUND:	Minor
DESCRIPTION:	
REVIEWER COMMENTS:	
REVIEWER /DATE	Stephen Lemiux Pearson Education Canada 10/30/01
ADDITIONAL INFORMATION:	More titles from Pearson Learning http://www.pearsonlearning.com/

The Writing Trek

The assessment of this computer-based learning tool, for deaf or hearing-impaired students, is based on criteria established by the Laurent Clerc National Deaf Education Center, 2001.

RATING: 1-Poor to 5-Excellent	4
PUBLISHER:	Sunburst Technology http://sunburst-store.com/
VERSION/CONTENTS:	Version: July 2000 Contents: CD disk Teacher's Guide
HARDWARE REQUIREMENTS:	PC Macintosh CD-ROM Sound Card
OPERATING SYSTEMS:	Macintosh System 7 Win 95, 98 & NT
COST: PRIORITIES:	$130. US (Excluding taxes and shipping) Literacy
APPROPRIATE FOR GRADES/LEVELS:	Middle (7-9) Secondary (9-12)
SUBJECT AREA(S):	Primary: Language Arts Secondary: Cross Curricular
INSTRUCTIONAL MODE:	Authoring System Creative Activity Multimedia Simulation
SOUND:	Moderate
DESCRIPTION:	This is a language learning adventure that will inspire students to write more and read more. Challenges include writing historical fiction, poetry, persuasive essays and Research reports. Journeys into Concept strands, skills and Internet research refine student writing. Models, Extension activities, and a Reading List are provided for each Project.
REVIEWER COMMENTS:	This program is attractive and stimulating for students, however with the Deaf students, there are limits to their full participation. Some activities do not include reading passages along with the sounds.
REVIEWER /DATE (Review originally submitted to Laurent Clerc National Deaf Education Center)	Lynn Stirling *7/31/2001*

ADDITONAL INFORMATION:	In the fall of 2001, Sunburst began distributing three separate The Writing Trek CD-ROM products. Product # 8664 for Grades 4-6 Product # 8672 for Grades 6-8 Twelve authentic language arts projects, activities, and assignments develop students' writing confidence and ability. Students explore concepts and techniques of experienced writers to understand key writing forms of poetry, fiction, non-fiction, and drama. Product # 8680 for Grades 8-10. More information available at: http://sunburst-store.com/

APPENDIX
RESEARCH LISTINGS

Title: Learnability constraints on ***deaf*** learners' acquisition of English wh-questions.

Subject(s): DEAF -- Means of communication; LANGUAGE acquisition

Source: Journal of Speech & Hearing Research, Jun96, Vol. 39 Issue 3, p625, 18p, 7 charts, 3 graphs

Author(s): Berent, Gerald P.

Abstract: Explores the knowledge of English wh-question formation in ***deaf*** college students in the context of government-binding theory and an associated learnability theory.

AN:9606274246

ISSN: 0022-4685

Note: Check library catalogue for holdings.

Database: MasterFILE Elite

Best Part

LEARNABILITY CONSTRAINTS ON *DEAF* LEARNERS' ACQUISITION OF ENGLISH WH-QUESTIONS

This article explores ***deaf*** college students' knowledge of English wh-question formation in the context of government-binding theory and an associated learnability theory. The parameters of universal grammar (UG) that are relevant to wh-question formation are identified, and predictions are made regarding the learning of the English values of these parameters in accordance with the subset principle, which, it has been proposed, guides the acquisition of UG parameter values that define languages ordered as proper subsets. The results of two learnability tasks revealed that, despite years of exposure to English language input, many ***deaf*** learners have not internalized the positive evidence required to set the marked values of the wh-question parameters. This finding provides strong empirical support for the subset principle. Theoretical and educational implications are discussed.

KEY WORDS: wh-questions, English, deaf, learnability, parameter

In contrast to their generally effortless acquisition of signed languages, ***deaf*** learners often experience tremendous difficulty in mastering the grammatical structure of spoken languages. Severely and profoundly ***deaf*** learners of English, for example, generally acquire English at a much slower rate than hearing learners of English do, and they experience persistent difficulty on many basic English syntactic structures (Berent, 1988, 1996; Quigley & King, 1980; Swisher, 1989). At the college level, persistent difficulties with English continue to interfere with educational success and are a factor in the high rate of ***deaf*** student attrition (Berent, 1993).

In recent years the linguistic theory known as government-binding (GB) theory, or the theory of principles and parameters (Chomsky, 1981, 1986), has been applied to questions of both first- and second-language acquisition with considerable success and is providing new insights into the mechanisms of language acquisition. In their tutorial on GB theory, Leonard and Loeb (1988) suggested that GB theory may also have fruitful application to issues of child language disorders, adult aphasia, and other areas of language learning and use under special circumstances.

The application of GB theory and associated theories of learnability is already providing new insight into ***deaf*** learners' acquisition of English. For example, Berent and Samar (1990) assessed *deaf* college students' knowledge of the English values associated with Wexler and Manzini's (1987) governing category parameter (GCP), a proposed parameter of universal grammar (UG), and found that this knowledge followed Wexler and Manzini's learnability predictions associated with the Gep. First of all, Berent and Samar found that students at both lower and higher levels of general English language proficiency exhibited 11 knowledge of the unmarked GCP value for English anaphors like himself in (1).

(1) [3 John knew [2 that Bill wanted [1 Tom to trust himself]]]

The governing category for himself in (1) is the bracketed portion labelled 1. Because an anaphor must have an antecedent inside its governing category, Tom is the only possible antecedent for himself in this sentence. Thus, the unmarked English GCP value defines a language that is smaller than the language defined by a more marked GCP value. For example, in a language with the governing category labelled 2, (1) would actually represent two sentences of that language, one in which Tom is the antecedent of himself and one in which Bill is the antecedent of himself.

Secondly, Berent and Samar (1990) found that *deaf* students differed according to general English proficiency level in their specific knowledge of the marked GCP value for English pronominals. The governing category for the pro-nominal him in (2) is the bracketed portion labelled 3.

(2) [1 John knew [2 that Bill wanted [3 Tom to trust himself]]]

Unlike an anaphor, a pronominal must have an antecedent outside its governing category. Although the governing categories of English anaphors and pronominals are equivalent, the GCP value for English pronominals is marked in that it defines a larger language than the less marked values do. That is, (2) represents three sentences of English, one in which Bill is the antecedent of him, one in which John is the antecedent, and one in which him has an external antecedent understood from some established context. The governing category labelled 1 in (2) represents the unmarked GCP value for pronominals. In a language with the unmarked value, (2) would represent only one sentence, one in which him has an external antecedent. Berent and Samar found that, although *deaf* students with higher English proficiency exhibited knowledge of the correct marked GCP value for English pronominals, students with lower English proficiency exhibited knowledge of the unmarked, but incorrect, GCP value.

The results of Berent and Samar (1990) follow from Wexler and Manzini's (1987) learnability predictions derived from the subset principle. For parameters whose values define languages that lie in a proper subset relation to one another, as is the case with the GCP, the subset principle stipulates that the language learner selects the value of a parameter that defines a language that is the smallest among the languages compatible with the input data (the actual sentences that the learner is exposed to).[1] An unmarked parameter value requires minimal positive evidence (input) to set during language acquisition, whereas more marked values require incrementally more positive evidence to set and thus might reasonably take longer to acquire (Wexler, 1993). Because the spoken language input generally available to ***deaf*** learners is severely restricted, it is reasonable to assume that unmarked parameter values requiring minimal positive evidence to set would be easily learned but that marked parameter values requiring a greater amount of positive evidence to set would be less learnable and would perhaps resist acquisition indefinitely. Indeed, in support of the subset principle, Berent and Samar found that, despite years of exposure to English, ***deaf*** learners with lower general English proficiency had not been able to internalize a sufficient amount of input to set a marked parameter of UG.

With respect to the performance of ***deaf*** students with higher English proficiency, Berent and Samar (1990) recognized that some ***deaf*** learners must be compensating somehow for the severe restriction in spoken English language input. For a variety of poorly understood reasons (perhaps earlier reading ability, early intervention, intense parental involvement) one learner may get a more sufficient amount of compensatory input than another to set marked parameter values, even though both learners might have the same degree of hearing loss. The learner who does not receive sufficient compensatory input early enough in life to set certain marked English parameter values might have a grammar characterized indefinitely by less marked, non-English values.

The present article extends GB and learnability theory to an investigation of ***deaf*** learners' acquisition of English wh-questions. Wh-questions reflect a range of markedness properties that allow further investigation into ***deaf*** learners' access to unmarked and marked structures of spoken languages. In the following sections, the UG principles and parameters associated with wh-question formation are identified, and predictions for the learnability of wh-question structures are elaborated. These predictions are then tested in a learnability study involving prelingually ***deaf*** college students. The results of this study are shown to support the validity of UG principles and parameters hypothesized within the GB framework and the learnability predictions associated with these principles and parameters. The results further support the application of GB theory in establishing principled explanations of ***deaf*** learners' grammatical knowledge of spoken languages such as English.

WH-QUESTIONS

The Syntax of Wh-Question Formation

Simple wh-phrases. Wh-question formation in English involves wh-movement. Within the "barriers" framework of GB theory (Chomsky, 1986), a wh-phrase moves from its underlying position within the inflectional phrase (IP) to the specifier (Spec) of the complementizer phrase (CP) at the beginning of the sentence. In (3), for example, the wh-phrase who moves from its position as direct object after the verb call in (3a) to Spec of CP in (3b), leaving a coindexed trace, t[sub i], in its vacated position.[2]

(3) a. [CP Spec [c, C [IP the director called who on the telephone]]]
b. [CP who [sub i] [C’did[sub j] [IP the director [I’t[sub j] [VP call t[sub I] on the telephone]]]]]

English wh-question formation as in (3) also involves subject-auxiliary inversion, in this case, do-support, whereby the auxiliary verb do, generated under inflection (Infl or I) within IP, moves to complementizer (C or Comp), the head position of CP. In (3), did moves to C, leaving a coindexed trace, t[sub j], in the Infl position before the verb phrase (VP) in (3b).

Within GB theory, traces mark the derivational history of moved constituents. In order for a derivation to be well-formed, traces must be properly governed in accordance with the empty category principle of Chomsky (1981, 1986). Essentially, a trace is properly governed if it is governed by a lexical element or if it is coindexed with a c-commanding element. In (3b), the trace of who, t[sub j], is properly governed via lexical government by the verb call, and the trace of did, t[sub j], is properly governed by its coindexed antecedent did[sub j] via antecedent government.

When a noun phrase (NP) position within an embedded clause is questioned, wh-movement involves movement out of the embedded IP, through the embedded Spec of CP, to the matrix Spec of CP. This process is illustrated in (4).

(4) a. [CP Spec [c’C [IP Brenda hopes [CP Spec [IP the director called who on the telephone]]]]]
b. [CP who[sub i] [C' does[sub j] [IP Brenda [I' t[sub i] [VP hope [CP t[sub i] [IP the director [I' called t[sub i] on the telephone]]]]]]]]

In (4b), there are two traces of wh-movement, t[sub i] in the governed position after called and the intermediate trace t'[sub i] in the Spec position of the embedded CP. Movement must proceed this way in steps in order not to violate the subjacency condition (see Chomsky, 1986, for details). Do-support applies as in (3).

Complex wh-phrases. Wh-questions like those in (5) and (6) below involve the movement of a wh-phrase containing not just a simple wh-word, but also a lexical noun.

(5)a. [CP Spec [C'C [IP the woman pulled [NP whose uncle] from the fire]]]

b. [CP [NP whose uncle][sub i] [C' did[sub j] [IP the woman [I' t[sub j] [VP pull t[sub i] from the fire]]]]]

(6) a. [CP Spec [C' C [IP Joanna dreamed [CP Spec [C' C [IP the woman pulled [NP whose uncle] from the fire]]]]]]

b. [CP [NP whose uncle] [sub j] [C' did[sub j] [IP Joanna [I, t[sub j] [VP dream [CP t'[sub i] [IP the woman [I' pulled t[sub I] from the fire]]]]]]]]

The wh-word in these examples is the possessive form whose, which occurs in the Spec position of the NP containing it and which is governed by the lexical head of the NP, from which it receives its possessive case form (Chomsky, 1981). The derivations of(5b) from (5a) and (6b) from (6a) otherwise parallel the derivations involving the simple wh-phrase (=who) in (3) and (4), respectively, above.

Parametric Variation in Wh-Question Formation

Wh-movement. Languages of the world vary with respect to the details of wh-question formation. Lillo-Martin (1990) suggested that there are at least three parameters involved in question formation. The first pertains to the level at which wh-movement takes place, that is, whether movement occurs overtly in the syntax, as it does in English, or only covertly at the conceptual level known as logical form, as it does in Chinese (Huang, 1982). The second pertains to whether syntactic wh-movement is optional when permitted, as it is in American Sign Language (ASL), or obligatory, as it is in English. The third pertains to how far a wh-phrase is permitted to move: for example, out of matrix clauses only, as in ASL, or out of matrix and embedded clauses, as in English.

At the level of overt syntax there are three basic wh-movement possibilities among languages of the world. Ignoring for the moment the question of optionality, we might propose that the facts of wh-movement define a parameter of UG with three values, as follows:[3]

(7) Wh-Movement Parameter

a. no overt wh-movement
b. wh-movement out of a matrix clause
c. wh-movement out of an embedded clause

From a learnability perspective, if the three values of the proposed wh-movement parameter can be shown to define languages that lie in proper subset relations to one another, as Wexler and Manzini (1987) demonstrated was the case with respect to the GCP, then the subset principle would apply to this parameter to guide the acquisition of wh-movement structures, including wh-question formation.

Values (7a), (7b), and (7c) of the wh-movement parameter do appear to define languages that lie in proper subset relations to one another. Value (7a) generates no questions formed via overt wh-movement, only questions in which the wh-phrase remains in situ (e.g., You saw who?). Value (7b) generates questions formed either via no movement or via movement from positions within a matrix clause. And value (7c) generates questions formed via no movement, via movement from positions within a matrix clause, or via movement from positions within an embedded clause. The language generated by each successive value contains all the sentences generated by the preceding value, plus additional sentences. Accordingly, the language defined by value (7 a) is a subset of the language defined by value (7b), which is a subset of the language defined by value (7c). Thus, (7) satisfies the subset condition of Wexler and Manzini (1987) and qualifies as a parameter of UG to which the subset principle applies.

However, it might be argued that the subset condition is really not met for this parameter because of the status of questions like You saw who? In some languages. In ASL, both the nonmovement option --YOU SEE WHO?-- and the movement option--WHO YOU SEE?--function as standard wh-questions. In English, You saw WHO? (with emphasis and rising intonation on WHO) and Who did you see? have somewhat different functions. Whereas Who did you see? is a standard wh-question, a structure like You saw WHO? is an echo question, which has a special discourse function of asking for clarification or repetition of missed information. Because of this difference one could object that value (7a) does not represent a subset of value (7b) because in some languages (e.g., English) echo questions and standard questions are distinct structures with distinct functions. [4]

Maxfield (1990) and Takahashi (1990) noted that early linguistic input to English-speaking children contains an abundance of both standard and echo wh-questions. Yet children appear not to know the distinction between the two types for some time. Takahashi noted that, if children do not know the distinction early on, they could conclude that wh-movement in English is optional, an assumption from which it would be difficult to recover (see also Roeper & de Villiers, 1992). That is, a language in which wh-movement is obligatory is a "smaller" language, with respect to the subset principle, than a language in which wh-movement is optional. In the first instance, movement constitutes the only option; in the second instance, movement and nonmovement constitute two options for the same phenomenon. Thus, retreating from optional to obligatory wh-movement would violate the subset principle.

But wh-movement per se is indeed optional in English in the sense that there is a nonmovement option generally employed for one discourse function (echo questions) and a movement option generally employed for another (standard questions). Actually, there is not a one-to-one correspondence between discourse function and syntactic structure, because the movement option can also be employed for echo questions. With emphatic stress on the wh-phrase and appropriate intonation, there is no apparent functional difference between WHO did you see? and You saw WHO? as requests for clarification of misheard information. Accordingly, one would not argue that the learner needed to set a wh-movement parameter associated with standard questions like Who did you see? and a separate wh-movement parameter associated with echo questions involving movement like WHO did you see?

A clue to children's gradual disambiguation of standard and echo wh-questions can be found in an interesting syntactic distinction between the two. As noted in Takahashi (1990), a standard wh-question targets a complete maximal projection such as an NP. For example, a response to What did you eat? might be A large piece of cake. In contrast, an echo question can question a maximal projection (You ate WHA T?), an intermediate projection (You ate a WHAT?), or just the head of a phrase (You ate a large WHAT?). These latter options are not available in standard wh-questions: [*]What did you eat a?, [*]What did you eat a large?

Besides recognizing the separate discourse functions of the two question types, children at some point must learn the fine syntactic differences between them as well. In this regard, the "DP-analysis" of Abney (1987) provides insight into the acquisition process.[5] With respect to first language acquisition, Radford (1988) proposed that children's early noun phrases are NPs rather than DPs because early noun phrases lack articles, personal pronouns, the possessive marker, and so forth, which are all Os under the OP-analysis. As acquisition proceeds, noun phrases eventually incorporate those components and become instantiated as DPs. De Villiers and Roeper (1995) provided further evidence that children begin with the assumption that noun phrases are NPs rather than DPs. Berent (1996) extended Radford's proposals to the discussion of ***deaf*** learners' grammatical knowledge of English, noting that ***deaf*** learners' noun phrases often lack the me constituents identified by Radford as lacking in hearing children's early grammars. Berent argued further that ***deaf*** learners' noun phrases grow, bottom up, from NPs to APs to DPs because of observed developmental patterns in their use of determiners, pronouns, and adjectives.

If noun phrases are acquired in this manner generally, it would imply that the syntactic distinction between standard and echo wh-questions is unavailable to early learners until such time that their noun phrases change from NPs to APs and eventually to DPs. The early confusion of standard and echo wh-questions follows from the fact that there is no syntactic distinction between them from the standpoint of the learner. Early input contains both question types, and the wh-movement parameter (7) is set on the basis of this mixed input. Subsequent syntactic development along with discourse disambiguation results in the learning of the distinctions. Thus, given the setting of English value (7c), wh-movement is optional with respect to wh-movement processes generally, and only later does additional input (or syntactic development) lead to knowledge of differences that set the two question types apart syntactically. In this sense, there is no violation of the subset principle as suggested by Takahashi (1990).

The question of optionality of movement in standard wh-questions is a separate matter. As noted above, ASL permits but does not require wh-movement out of matrix clauses in standard questions, whereas English appears to require wh-movement in standard questions (Lillo-Martin, 1990). If we regard (7) as a parameter of wh-movement generally, then optionality of movement specifically in standard wh-questions must be associated with a separate UO parameter. This optionality parameter would presumably have two values: (a) nonoptional and (b) optional. The acquisition of wh-question formation would then proceed as follows: The learner sets the wh-movement parameter (7) to value (a), (b), or (c) on the basis of positive evidence indicating the extent to which wh-phrases move; subsequently, the learner learns the distinction between standard and echo questions on the basis of discourse factors and after recognizing the NP/DP distinction; finally, the learner sets the optionality parameter for standard questions to the appropriate setting. The existence of two (or more) wh-question parameters is allowed on the basis of Wexler and Manzini's (1987) independence principle, which stipulates that "the subset relations between languages generated under different values of a parameter remain constant whatever the values of the other parameters are taken to be" (p. 65). That is to say, there is no interaction between the learner's setting of the wh-movement parameter and the setting of the optionality parameter.

Parametric variation and do-support. Languages differ as to whether they allow two lexical elements at the beginning of a CP constituent, one in Spec of CP and another in the head position C of CP. For example, English disallows structures like (9), in which who is in the Spec of the embedded CP and whether is in the C position.

(8) [CP I wonder {CP who [sub I] [c, whether [IP t[sub i] has read the book]]]]

Although ungrammatical in English, the equivalent structure is grammatical in Dutch (Koopman, 1983). In English, structures like (8) are ruled out by the doubly filled Comp filter, which does not apply in Dutch.

However, the doubly filled Comp filter holds in English only of embedded CP constituents. When two elements appear within the CP of a matrix clause, the filter is overridden (Aoun, Hornstein, Lightfoot, & Weinberg, 1987). Therefore, wh-movement structures like (3b) above, in which a wh-phrase appears in Spec and an auxiliary verb appears in C of a matrix CP, are allowed. This difference between embedded and matrix CPs is driven by government theory and indexing conventions of OB theory that must apply to a governed CP complement but not to an ungoverned matrix CP (see Aoun et al. for details).

Because some languages respect the doubly filled Comp filter whereas others do not, Weinberg (1990) interpreted the filter as a parameter of UG. Under the common assumption that acquisition proceeds on the -basis of positive, and not negative, linguistic evidence, Weinberg argued that application of the filter (the English value) is the unmarked value of the parameter. Otherwise, if learners' first assumption was that the filter did not apply, they would have to hear (nonexistent) negative examples like (8) along with information that they are ungrammatical structures in order to determine that the filter did apply in English. Therefore, Weinberg maintained that, in accordance with the subset principle, learners assume application of the filter until they receive enough positive evidence to trigger resetting the parameter to the marked value (nonapplication of the filter), as in Dutch.

Because English wh-question formation leads to a violation of the otherwise unmarked application of the doubly filled Comp filter, Weinberg (1990) argued that subject-auxiliary inversion in wh-questions is a marked parametric option that must be learned through sufficient positive evidence. The positive examples required to establish this marked option are wh-questions formed on positions other than matrix subject position, such as (3b) and (4b) above, which involve both wh-movement and do-support. As Weinberg explained, movement from matrix subject position, as in (9) below, does not constitute evidence that the doubly filled Comp filter is violated in the matrix CP.

(9) a. [CP Spec [C, C [IP who hid the letter from the president]]]
b. [CP who [sub i] [C' [IP t[sub I] hid the letter from the president]]]

That is, the learner could interpret the question in (9) as involving no movement as in (9a), as opposed to (9b), which involves wh-movement. It is subject-auxiliary inversion in conjunction with wh-movement which provides the positive evidence that the CP constituent is doubly filled. [6]

Learnabilty Predictions for English Wh-Question Formation

The analyses of wh-movement and do-support discussed above within the GB framework lead to clear predictions for the learnability of wh-questions under conditions of restricted spoken language input. As demonstrated in Berent and Samar (1990) with respect to the GCP, ***deaf*** learners of English with lower general English language proficiency exhibited greater knowledge of unmarked UG parameter values but less knowledge of marked values (see also Berent, 1990; 1996). In contrast, ***deaf*** learners with higher general English language proficiency exhibited knowledge of both the unmarked and marked values. Accordingly, we would predict that ***deaf*** learners' knowledge of the parameter values associated with English wh-question formation is also guided by markedness hierarchies established for these parameters in conformity with the subset principle. Thus, these learners would be expected in general to exhibit less knowledge of the more marked values of these parameters and to exhibit greater knowledge of the marked values as overall English language proficiency increases.

Given Weinberg's (1990) analysis of the marked status of wh-movement and accompanying subject-auxiliary inversion as a violation of the unmarked application of the doubly filled Comp filter, we should expect ***deaf*** learners of English who have presumably experienced the severest restriction of English language input in early life to have difficulty generally with the syntax of English wh-question formation because of the marked status of wh-movement in English and the marked nature of do-support. However, as overall English language proficiency increases, which we presume reflects the ability to have compensated in certain ways for restricted English language input in early life, we would expect to see relatively greater knowledge of wh-question formation. Thus, Prediction A:

> (A) ***Deaf*** *learners'* knowledge of English wh-question formation will improve as a function of overall English language proficiency.

The parametric variation in wh-movement across languages discussed above led to the proposal that no movement in wh-question formation reflects the unmarked value (7a) of the wh-movement parameter, that movement associated with (7b) reflects a more marked value, and that movement associated with (7c) reflects the most marked parameter value. As noted above with respect to (9), questions targeting matrix subject position might be analyzed as involving no wh-movement at all, as in (9a). Moreover, they do not involve subject-auxiliary inversion. Because questions like (9a) are unmarked on two counts, they should require minimal positive language evidence to learn; hence, Prediction B:

> (B) ***Deaf*** learners of English will exhibit superior performance on wh-questions targeting matrix subject position, regardless of English proficiency level.

The markedness hierarchies associated with wh-movement parameters might manifest themselves in ***deaf*** learners' grammars in a variety of ways, depending on English proficiency level. With relatively high proficiency, ***deaf*** learners might exhibit full knowledge of wh-question formation. With relatively lower overall proficiency, they might exhibit greater knowledge of wh-questions targeting matrix NP positions than questions targeting embedded NP positions. The greatest restriction of English input in early life, reflected in quite low overall proficiency, should result in little knowledge of questions targeting positions other than matrix subject. These considerations lead to Predictions C and D.

> (C) ***Deaf*** learners with low overall English language proficiency will exhibit little knowledge of wh-questions involving movement.

> (D) ***Deaf*** learners with somewhat higher overall English language proficiency will exhibit greater knowledge of wh-questions targeting matrix NP positions than wh-questions targeting embedded NP positions.

Finally, with regard to wh-questions targeting possessive NPs and involving the movement of a complex wh-phrase containing whose plus a head noun as in (5) and (6) above, it was noted that the derivation of such questions parallels the derivation of wh-questions containing a simple wh-phrase. Subject-auxiliary inversion occurs in the same environments, and movement is possible from the same NP positions. The fact that movement of a wh-phrase containing whose involves the movement of a larger constituent with its own internal syntax might prompt the prediction that learners would exhibit less knowledge of questions containing such wh-phrases because of the additional syntactic complexity. This is stated as Prediction E[sub 1].

> (E[sub 1]) ***Deaf*** learners of English will exhibit greater knowledge of wh-questions targeting simple, nonpossessive NPs than of comparable wh-questions targeting possessive NPs.

Alternatively, it is possible that the presence of the explicit head noun in complex wh-phrases actually facilitates the learning of wh-movement. Berent (1988) showed that adult ***deaf*** learners of English were more successful on structures in which nominal and verbal arguments were represented as explicit lexical elements than on structures containing empty categories and other functional elements. In a question like (5) above, Whose uncle did the woman pull from the fire?, the transitive verb pull requires a following object which in this sentence is the gap (trace) left after wh-movement of the phrase whose uncle. Because of the presence in the sentence of the explicit lexical noun uncle, it might be easier for the learner to associate this noun with the verb pull than it would be to associate the nonlexical, functional element who in the question Who did the woman pull from the fire? These factors motivate the competing Prediction [sub 2].

> (E[sub 2]) ***Deaf*** learners of English will exhibit greater knowledge of wh-questions targeting possessive NPs than of comparable wh-questions targeting nonpossessive NPs.

There appears to be no clear way to decide, a priori, between Predictions E[sub 1] and E[sub 2], because they have totally independent motivations, one pertaining to the internal syntax of the wh-phrase, the other pertaining to syntactic relations within the entire sentence.

Deaf learners' knowledge of English wh-questions were assessed and Predictions A-E were tested in the learnability study described below.

METHOD

Subjects

Forty-six prelingually ***deaf*** young adults pursuing undergraduate degrees at the National Technical Institute for the ***Deaf*** at Rochester Institute of Technology participated in the study. A normal-hearing control group of 14 students (mean age = 26.2, SD = 8.1) pursuing degrees in sign language interpreting at the same institution also participated. All of the ***deaf*** students had severe or profound hearing losses, and all had normal-hearing parents. In all cases, deafness was discovered before age 1.

The ***deaf*** students were divided into three groups on the basis of their scores on the Michigan Test of English Language Proficiency (English Language institute, 1977), a test of general English language proficiency in grammar, vocabulary, and reading comprehension. The Michigan Test has been used elsewhere (Berent, 1990, 1993; Berent & Samar, 1990) to categorize *deaf* students for the purpose of exploring learnability factors influencing English language proficiency. The High, Mid, and Low Michigan groups consisted of 13, 15, and 18 students, respectively.

Table 1 summarizes the Michigan Test means and other background characteristics of the three *deaf* groups. Besides differing according to their Michigan Test scores, the three groups also differed significantly according to reading level, $F(2, 43) = 36.2$, $P < .0001$. The differences between the mean reading scores of all three groups were significant at $p < .05$ (Tukey HSD). The three groups did not differ significantly in age or in pure tone average hearing loss. However, they did differ in sign language proficiency, $F(2, 43) = 8.39$, $P < .001$, as measured by the Sign Instruction Placement Interview (Caccamise, Armour, & Burfield, 1984). Post hoc comparison of the means for the three groups revealed that the sign skills of the Low Michigan group were superior to those of the High and Mid groups ($p < .05$), which did not differ significantly from one another (Tukey HSD). It was not possible to select three subject groups that were equivalent in sign language skills because the subject pool from which the Low Michigan students was selected consisted mostly of students with scores of 4 or 5 on the Sign Instruction Placement Interview. The scores of the higher Michigan subject pools were on average lower than 4. Thus, the essential differences between the three ***deaf*** student groups pertained to overall English language proficiency and the higher sign language proficiency of one of the groups.

Materials

Two pencil-and-paper tasks were devised to assess students' knowledge of English wh-questions. A 60-item question formation (QF) task and a 120-item grammaticality judgment (G J) task were administered to the students individually or in small groups of two or three. Written instructions were provided for each task. After subjects read the written instructions, the experimenter repeated them in English and in sign language and made certain that subjects understood how to complete each task. Because the GJ task included target structures that students might be able to model in completing the QF task, the QF task was administered first.

Of the two tasks, it was considered that the QF task, as a production task, would more accurately reveal the students' tacit grammatical knowledge of English wh-questions. Recent assessments of the use of GJ tasks with hearing second-language learners have revealed that performance on such tasks may not necessarily reflect grammatical knowledge but may be influenced by other pragmatic factors, processing effects, and so forth Ellis, 1991; Schachter & Yip, 1990). Therefore, it was considered that the GJ task would provide results that might corroborate or supplement the results of the QF task.

On the QF task students were required to convert English sentences to corresponding wh-questions by changing underlined words to who or whose, as appropriate, and making any other necessary changes. For example, the correct formations derived from stimuli (10a) and (11a) are (10b) and (11 b), respectively.

(10) a. Mary said the officer gave the bomb to the soldier. b. Who did Mary say gave the bomb to the soldier?

(11) a. The woman pulled the professor's uncle from the fire. b. Whose uncle did the woman pull from the fire?

On the GJ task students were required to decide whether English questions were grammatical or ungrammatical. The words YES and NO appeared to the right of each stimulus question. If a question was considered grammatical, a student circled YES; if it was considered ungrammatical, the student circled NO. In contrast to grammatical English questions like those in (12), ungrammatical questions like those in (13) contained a resumptive pronoun (him/his) in the position otherwise occupied by the trace of wh-movement.

(12) a. Who did the kid grab the hat from?
b. Whose cousin does Bonnie assume heard the story from the workman?

(13) a. Who did the kid grab the hat from him?
b. Who does Bonnie assume his cousin heard the story from the workman?

Though generally not available in adult English, questions containing resumptive pronouns are a grammatical option in certain languages, and they are used by children learning English as a first language at certain stages (Perez-Leroux, 1995; Thomton, 1995). Therefore, they were included as subtle ungrammatical foils on the GJ task to determine the extent to which ***deaf*** learners of English might accept them as grammatical. Because the positions of resumptive pronouns indicate the grammatical relations of the wh-phrases to which they refer, ***deaf*** learners might prefer them over gaps in more marked wh-question structures. Furthermore, some analyses of resumptive pronouns derive them via nonmovement of the wh-phrase (e.g., Shlonsky, 1992). If these analyses are correct, the learner might have access to less marked wh-question formation strategies at certain stages.

Structures targeted on both tasks appear in Table 2. The QF task included stimuli targeting five tokens of each of the 12 grammatical question types listed in the table, for a total of 60 items. The gap () shown in each grammatical question represents the underlying position from which a wh-phrase has moved to the Spec of the matrix CP position. Grammatical questions 1-3 are structures in which a matrix subject, direct object, and object of preposition, respectively, are questioned. In the grammatical questions 4-6, a possessive NP contained within the same three matrix positions is questioned. Grammatical questions 7-12 are parallel to questions 1-6 except that the questioned positions appear within embedded, rather than matrix, clauses. The GJ task included five tokens of each of the same 12 grammatical question types listed in Table 2 and included, additionally, five tokens of each of the 12 parallel ungrammatical question types maintaining resumptive pronouns, for a total of 120 items, 60 grammatical and 60 ungrammatical. Items appeared on both tasks in random order.

The length of each questions type, in terms of number of words, is indicated to the right of each example in

Table 2. In order to target a variety of questioned positions, sentence length varied from 7 to 12 words. All tokens of a given question type had the same number of words.

Scoring

A question produced on the QF task was scored as correct if it employed who or whose appropriately to question the underlined constituent of the stimulus sentence, if it reflected appropriate movement of the wh-phrase, if it included do-support where required, and if the grammatical relations of the original stimulus sentence were preserved. Because of persistent errors in English morphology experienced by many prelingually ***deaf*** users of English, number, tense, and agreement errors were not counted, nor were spelling errors or errors in the use of articles. Who and whom were equally acceptable in nonsubject positions.

On the GJ task, a YES response to a grammatical question was scored as correct, and a NO response was scored as incorrect. Conversely, a NO response to an ungrammatical question was scored as correct, and a YES response was scored as incorrect.

Analyses

Analysis of variance. The ***deaf*** students' data from the QF task and their data from the GJ task were analyzed in separate analyses. For all analyses, percentage scores were converted to arcsine values, and the data were analyzed using the multivariate approach to repeated measures. In the QF analysis of variance (ANOVA), Group (High, Mid, Low) was the between-subjects factor, and Clause (matrix, embedded), Wh-phrase (simple, possessive), and Position (subject, direct object, object of preposition) were the within-subject factors. In the GJ ANOVA, Group (High, Mid, Low) was again the between-subjects factor, and the within-subject factors were Grammaticality (grammatical, ungrammatical) and, as in the QF NOVA, Clause, Wh-phrase, and Position. Post hoc comparisons were conducted using the Games-Howell Multiple Comparisons Test to take into account unequal cell n's and pairwise means contrasts for the repeated measures.

Data on the hearing students were studied separately from the data on the ***deaf*** students because it was anticipated that normal-hearing native speakers of English would perform at near-perfect levels on the tasks. Because the hearing students' performance was in fact near-perfect, ANOVAs could not be performed on their data.

Analysis of production errors. In addition to analysis of variance, students' production errors on the QF task were analyzed to determine the types of errors ***deaf*** learners make in attempting to form wh-questions. They were analyzed also to determine whether certain errors might reflect possible stages in the acquisition of wh-questions reported elsewhere in the literature (e.g., hearing children's use of resumptive pronouns) and whether error patterns might support any of the learnability predictions for wh-question formation derived from the subset principle.

RESULTS AND DISCUSSION

Question Formation Task

ANOVA results. Out of a possible score of 60, the hearing students achieved a mean score of 55.6 (SD = 5.4) or 92.6% correct on the QF task. Virtually all errors made by the hearing subjects were instances of grammatical questions formed on nontarget positions (3.0%) or wh-questions without movement (3.7%) and did not reflect deficiencies in the syntax of English question formation.

The significant main effects and interactions obtained in the QF ANOVA on the ***deaf*** students’ data are listed In Table 3. With respect to the main effect for Group, the High Michigan group achieved a mean score of 40.2 (SD = 17.7) or 66.9% correct, the Mid Michigan group achieved a mean score of 32.3 (SD = _.8) or 53.8% correct, and the Low Michigan group achieved a mean score of 14.9 (SO = 13.6) or 24.8% correct. Post hoc analysis revealed significant differences among pairwise comparisons of all three means ($p < .05$). This performance pattern reveals, in confirmation of Prediction A given above, that ***deaf*** learners' knowledge of English wh-question formation improves as a function of overall English language proficiency.

The main effect for Wh-phrase noted in Table 3 indicates that the ***deaf*** students were more successful in forming questions involving a simple wh-phrase (who structures), on which they were 50.7% correct, than in forming questions involving the movement of a complex wh-phrase containing a possessive NP (whose structures), on which they were 41.6% correct. This result supports Prediction E[sub 1] over Prediction E[sub 2]. That is, the internal structure of the wh-phrase affects learners' ability to form wh-questions; there is no facilitation from the explicit presence of the head noun.

The main effect for Clause indicates that the *deaf* students were significantly more successful in forming wh-questions in which a main clause constituent was questioned (60.8% correct) than those in which an embedded clause constituent was questioned (31.5% correct). This result in general supports Prediction D with respect to markedness considerations but does not verify relative differences among proficiency levels (see below).

The main effect for Position reveals that the students were more successful in forming questions involving subject position (55.5% correct) than they were on either direct object position (41.6% correct) or on object of preposition position (41.3% correct). Follow-up contrasts verified that performance on subject position was significantly higher than performance on the other two positions, which did not differ significantly from one other ($p < .01$). However, the Position main effect disguises the effect of clause type on position because, for example, the mean for subject position conflates performance on matrix and embedded subject positions.

The Clause x Position interaction noted in Table 3 reveals that the ***deaf*** students' success at forming wh-questions on the three targeted positions assumed different patterns depending on which clause those positions occurred in. With matrix clauses, the students were more successful on subject position (85.9% correct) than on either direct object position (47.6% correct) or object of preposition position (48.9% correct). Follow-up contrasts revealed that the mean for matrix subject position differed significantly ($p < .006$) from the means for matrix direct object and object of preposition, which did not differ significantly from one another. With embedded clauses, the students were least successful on subject position (25.2% correct) and more successful on both direct object position (35.7% correct) and object of preposition position (33.7% correct). Follow-up contrasts revealed that the mean for embedded subject position differed significantly ($p < .006$) from the means for embedded direct object and object of preposition, which did not differ significantly from one another.

In the absence of a 3-way interaction involving Group, the observed overall performance on matrix subject position supports Prediction B, which states that ***deaf*** learners will exhibit superior performance on wh-questions targeting matrix subject position, regardless of English proficiency level. Although no markedness prediction was made about relative performance on the three embedded clause positions, the observed lowest performance on embedded subject position is of theoretical interest.

As noted above in the discussion of wh-movement and do-support, the trace of a moved constituent must be properly governed in accordance with the empty category principle (Chomsky, 1981, 1986), either via lexical government or via antecedent government. In the derivation of question (4b) above, repeated below in (14), the trace t[sub i] is lexically governed by called, and the trace t'[sub i] is antecedent-governed by who.

(14) [CP who [sub i] [C' does[sub j] [IP Brenda [I' t[sub j] [VP hope [CP t'[sub j] [IP the director [I' called t[sub i] on the telephone]]]]]]]]

In fact, the original trace of all nonsubject wh-phrases has a lexical governor--a verb in the case of a direct object and a preposition in the case of an object of preposition. With respect to subjects, on the other hand, the original trace of the wh-phrase is antecedent-governed. In the case of movement from an embedded subject position, as in (15), t[sub i] is antecedent-governed by t[sub i], which is in turn antecedent-governed by who.

(15) [CP who [sub i] [C' did[sub j] [IP Betty [I' t[sub j] [VP dream [CP t'[sub i] [IP t[sub i] [I' hid the letter from the president]]]]]]]]

In the case of matrix subject position, although the wh-trace is antecedent-governed by the moved wh-phrase [see (9b) above], recall that the learner might hypothesize non-movement as in (9a). Under this hypothesis, embedded subject position is the only position in which a wh-trace is unambiguously antecedent-governed. Thus, the distinction between lexical and antecedent government is apparently the factor responsible for the lowest performance on the embedded subject position. This conclusion is supported for acquisition generally by the results of Stromswold (1995), who provided evidence that hearing children acquire wh-questions targeting embedded subject position last, a fact which she too attributed to antecedent government.

The last significant interaction listed in Table 3, the Groupx Position interaction, resulted from a different success pattern by group on questions targeting subject, direct object, and object of preposition. For the three positions, percentages of correct productions for the three groups were 74.2, 63.5, and 63.1, respectively, for the High Michigan group; 55.7, 53.3, 52.3, respectively, for the Mid Michigan group; and 41.9, 16.1, and 16.4, respectively, for the Low Michigan group. However, as noted with respect to the main effect for Position, the Position variable reflects performance averaged across clause type, so that these means disguise the theoretical implications of the results.

The QF ANDV A yielded a Group x Clause x Position interaction that was just shy of significance at p = .068. The means associated with this interaction, illustrated in Figure 1, provide the clearest picture of the effects of markedness factors on the grammars of ***deaf*** learners of English. The fact that the performance patterns of the Clause x Position interaction did not quite differ significantly by group is a consequence of the range in overall task performance within each of the Michigan groups. That is, although the Group main effect verifies that ***deaf*** learners' knowledge of English wh-question formation improves as a function of overall English language proficiency, the large standard deviations associated with the group means (see above) reveal that each group contains a few learners whose performance on wh-questions is above or below what their overall English proficiency would predict. It is likely that the Michigan Test simply fails to assess knowledge of English wh-movement.

Sentence length as a factor. Recall from Table 2 that the target structures on the QF task consisted of questions that varied in length depending on which NP position was questioned. In order to question a variety of matrix and embedded positions, it was necessary to vary sentence length in this way. If other nominal and verbal constituents in the sentence were not consistent in length or if other constituents (e.g., adjectives and adverbs) had been added in some places to balance all sentences in length, other extraneous factors would have been introduced that might obscure the results. Nevertheless, a reasonable hypothesis is that variation in sentence length (7 to 11 words on the QF task) might explain the ANDV A results.

However, an examination of the ANOVA results in this context virtually eliminates sentence length as an explanation. Where significant differences between means were observed, the groups of sentences contributing to those means were often either close or equivalent in average length. For example, with respect to the main effect for Position discussed above, performance on subject position was superior to performance on direct object and object of preposition position, which were equivalent. Table 2 grammatical sentence types 1 (=7 words), 4 (=8 words), 7 (=10 words), and 10 (=11 words) all contributed to the subject position mean for an average sentence length of 9 words, and sentence types 2 (=8 words), 5 (=9 words), 8 (=10 words), and 11 (=11 words) all contributed to the direct object position mean for an average sentence length of 9.5 words, an average half a word longer than the subject position mean. The average sentence length associated with the object of preposition mean was similarly 9.5 words. Actually, if the length of the QF stimuli, rather than the length of the target structures themselves, is regarded as the relevant factor, the three means are identical in average sentence length at 9.5 words.

As another example, in the case of the Clause x Position interaction reported above, the average sentence length associated with the embedded subject, embedded direct object, and embedded object of preposition means was identical (=10.5 words) for both stimuli and target responses. Yet performance on embedded subject position was significantly lower than performance on the other two positions. If sentence length were the relevant factor accounting for the results, the resulting differences between means could not be explained. Therefore, it is assumed that students' performance on the QF task is a reflection of their grammatical knowledge.

Grammaticality Judgment Task

ANOV A results. Out of a possible score of 120 on the GJ task, the hearing students achieved a mean score of 117.9 (SO = 2.8) or 98.2% correct. This near-perfect performance validates the grammatical status of the target structures employed in this study on the basis of hearing native speaker intuitions.

The significant main effects and interactions obtained in the GJ ANOV A on the ***deaf*** student data are listed in Table 4. As in the QF ANOV A, there was a significant main effect for Group. The High Michigan group achieved a mean score of 109.0 (SO = 12.9) or 90.8% correct on the GJ task; the Mid Michigan group achieved a mean score of 97.5 (SO = 15.9) or 81.2% correct; and the Low Michigan group achieved a mean score of 74.4 (SD = 18.7) or 62.0% correct. Post hoc analysis revealed significant differences among pairwise comparisons of all three means ($p < .05$). This result provides additional support for Prediction A.

The main effect for Grammaticality reveals that the ***deaf*** students were, overall, significantly more successful at judging grammatical questions grammatical (83.2% correct) than they were at judging ungrammatical questions ungrammatical (69.7% correct). However, the type of wh-phrase contained in the question was also a factor. The Grammaticality x Wh-phrase interaction indicates that the students were significantly more successful ($p < .01$) at judging grammatical questions involving possessive phrases containing whose plus a lexical NP (85.4% correct) than at judging those involving a simple wh-phrase represented by who alone (80.9% correct). Thus, contrary to the results of the QF analysis supporting Prediction E[sup 1], the results of the GJ analysis support Prediction E[sup 2]. The presence of an explicit lexical noun in the wh-phrase apparently assists judgments of grammaticality by facilitating the identification of a moved wh-phrase with its trace.

However, the Grammaticality x Wh-phrase interaction revealed that, with ungrammatical questions, there was a trend for success to be slightly lower on whose structures ($p = .057$). The students were 71.4% correct at judging ungrammatical questions containing a simple wh-phrase and 68.0% correct at judging those containing a possessive phrase. In the case of ungrammatical stimuli, recall that all of the questions contain ungrammatical resumptive pronouns. In the case of the ungrammatical stimuli corresponding to grammatical stimuli containing possessive wh-phrases, all contain his (see ungrammatical items 4-6 and 10-12 in Table 2). Some of these questions start to sound almost acceptable, which may have made them slightly more difficult to rule out.[7] A clearer assessment of judgments of questions involving possessive NPs might have been obtained in a task in which the ungrammatical foils were structurally more similar to the grammatical items.

The main effect for Clause noted in Table 4 indicates that the ***deaf*** students were significantly more successful in judging questions in which a matrix clause constituent was questioned (81.2% correct) than in judging questions in which an embedded clause constituent was questioned (71.6% correct). This result supports Prediction 0 in a general sense (i.e., irrespective of proficiency level).

However, the Clause x Position interaction shows that performance on questions targeting matrix subject position (90.2% correct) exceeded performance on questions targeting a matrix direct object (76.7% correct) and object of preposition (76.7% correct) as well as those targeting the three embedded positions: subject (68.7% correct), direct object (72.1 % correct), and object of preposition (74.1 % correct). This superior performance on matrix subject position supports Prediction B also in a general sense, irrespective of level. Although there was no significant interaction incorporating Group, Clause, and Position, an examination of the Low Michigan group's means reveals that they were 78.3% correct on matrix subject position but only between 57.2% and 60.6% correct on all other positions. Furthermore, whereas no student in the Mid or High Michigan groups attained an overall score of less than 60%, 11 of the students in the Low Michigan group performed between 40% and 60%. Given that chance performance is 50%, these figures associated with the low Michigan group indicate little knowledge of the status of English wh-questions involving wh-movement, in support of Prediction C.

Because the Position variable involves position means averaged across clause type, discussion of the Position main effect and the 2-way interactions involving Position would be relatively uninformative, especially in light of the two 3-way interactions involving Position, which might offer meaningful detail. Similarly, the 2-way Clause x Wh-phrase interaction is further elaborated in the 3-way interaction incorporating those two variables.

The Group x Grammaticality x Position interaction is illustrated in Figure 2. The figure shows that performance on grammatical and ungrammatical questions assumes a different pattern across the three target positions (averaged across clause type) for each group. Unfortunately, these patterns provide no discernibly meaningful insights and probably result from the added complexity introduced by the Grammaticality variable along with any pragmatic preferences associated with individual items.

The Clause x Wh-phrase x Position interaction is illustrated in Figure 3. With simple wh-movement structures, the ***deaf*** students were clearly most successful on questions targeting matrix subject position (Prediction B). The greatest divergence in performance occurred between questions targeting a matrix subject and those targeting an embedded subject, with convergence between clause types occurring at object of preposition. Simple effects analysis of the embedded clause data revealed a main effect for Position, $F(2, 42) = 8.71$, $p < .001$, indicating that performance decreased significantly from most success on embedded object of preposition to least success on embedded subject. The difference between performance on the antecedent-governed embedded subject position and performance on the lexically governed embedded direct object and object of preposition positions was significant at $p < .0002$. This result provides additional support to the discussion in the QF analysis of the role of antecedent government in the acquisition of wh-questions like (15) above.

With respect to wh-movement structures involving possessive NPs, Figure 3 shows that the ***deaf*** students here again most successful on matrix subject position, with near convergence in performance among the other positions. Simple effects analysis revealed that performance did not vary significantly over embedded clause positions involving possessive NPs. Performance did not vary significantly on questions targeting these positions, possibly because, as noted, all of the relevant items included an explicit lexical noun associated with the target positions, facilitating grammaticality judgments across the three embedded positions.

Sentence length as a factor. As argued above with respect to the QF ANOVA results, sentence length can also be ruled out as an explanation for the results of the GJ ANOVA. As indicated in Table 2 above, grammatical questions appearing on the GJ task ranged in length from 7 to 11 words, and ungrammatical questions ranged in length from 8 to 12 words. In some cases significantly different means were associated with groups of sentences having equivalent average sentence lengths, and in other cases means between which there was no significant difference were associated with groups of sentences having different average sentence lengths.

For example, with respect to the Clause x Position interaction, the average sentence length associated with the matrix direct object and object of preposition means was 9 words, and the average length associated with the embedded subject, direct object, and object of preposition means was 11 words. Yet performance on all these positions was equivalent. With respect to the Clause x Wh-phrase x Position interaction, performance on the embedded object of preposition position was superior to performance on the embedded direct object position, which was superior to performance on the embedded subject position. Yet the average sentence length associated with all three of these means was 10.5. Such examples demonstrate that sentence length cannot explain the results of the GJ task, and, therefore, it is assumed that performance on this task is a reflection of ***deaf*** learners' grammatical knowledge.

Congruence of Task Results

As noted in the Method section, GJ tasks used with hearing second-language learners have sometimes been known to be unreliable indicators of learners' grammatical knowledge because they might reflect pragmatic references or processing effects as well (Ellis, 1991; Schachter & Yip, 1990). Accordingly, the GJ task in the present study was expected to possibly supplement the results of the primary QF task. Although the production of syntactic structures and the recognition of grammaticality might tap different aspects of grammatical knowledge, the results of the QF and GJ tasks were surprisingly congruent. With the exception of learnability Predictions E[sup 1] and E[sub 2], each task provided fairly strong support for Predictions A-D. Furthermore, both tasks revealed that ***deaf*** learners were least successful on questions targeting the embedded subject position [see (15) above], which, unlike the other NP positions, involves antecedent government rather than lexical government. Because these convergent results are based on grammatical factors tied to a specific theoretical framework, this study provides evidence that a GJ task used with ***deaf*** learners of English is a reliable indicator of learners' grammatical knowledge.

In fact, for the ***deaf*** students the QF and the GJ task results correlated significantly with each other at $r = .70$ using a Pearson product-moment correlation, $t(44) = 43.13$, $p < .001$. This is a fairly robust correlation given that the QF task is an active test of linguistic production, whereas the GJ task is a reflective test of sentence acceptability. The .70 correlation suggests that the two tasks are indeed tapping knowledge of the same underlying grammatical phenomena.

Results of the Production Error Analysis

Error types. An examination of responses on the QF task revealed that students made errors that fell into the major categories listed in (16).

(16) a. No movement:	The director called who on the telephone?
b. Resumptive pronoun:	Who did the director call him on the telephone?

c. Do-support error:	Who did gave the bomb to the soldier?
	Who the teacher explained the answer to?
d. Who/whose confusion:	Who cousin heard the story from the workman?
	Whose explained the answer to the guest?
e. Nontarget question:	Who called the director on the telephone?
	for Who did the director call on the telephone?
f. Other/multiple errors:	Whose friend that the maid kept the secret from?
	Whose the coach kicked the ball to, Mary said?

These error types occurred with either sufficient frequency or sufficient infrequency to be of theoretical interest and thus to be further analyzed. Table 5 lists the percentages of errors in each category of (16) made by each student group on the QF task, along with their percentages of correct question formations. For each error category except the last, percentages represent the incidence of productions containing that error type alone, excluding number, tense, agreement, article, and spelling errors as noted in the section on Scoring.

As already noted, errors made by the hearing control group were limited essentially to a few instances of non-movement of a wh-phrase and the production of a few nontarget question types. The fact that the hearing group produced very few no movement structures at all, as seen from Table 5, indicates that they were producing standard, and not echo, questions in response to the QF task stimuli. The ***deaf*** groups' production of higher percentages of no movement structures suggests either a confusion between standard and echo questions in English, as discussed by Maxfield (1990) and Takahashi (1990) for hearing children, or the employment of non movement as the unmarked value (7a) of the wh-movement parameter, presumably because of restricted access to the more marked structures associated with values (7b) and (7 c). Table 5 reveals that all three ***deaf*** groups resorted to non movement to varying extents (see the discussion of other/multiple errors below).

With respect to resumptive pronouns, as in (16b), despite the fact that on the GJ task questions containing resumptive pronouns were accepted as grammatical with increasing frequency as proficiency level decreases (Figure 2), Table 5 reveals that virtually no questions containing resumptive pronouns were produced by the students. The discrepancy between the tasks in this regard suggests that, although such structures may be judged as grammatical alternatives to wh-questions without resumptive pronouns for some learners, the production of resumptive pronouns is not an active strategy employed by ***deaf*** college students for avoiding marked wh-movement structures in English.

Do-support errors, as in (16c), included both the inappropriate presence of do in questions targeting matrix subject position and, most often, the absence of do-support required in all the other question formations. The absence of do-support is consistent with certain stages in hearing children's acquisition of wh-questions (Radford, 1994) and is consistent with the markedness predictions associated with both the doubly filled Comp filter (Weinberg, 1990) and the wh-movement parameter. In the latter case, non movement as the reflection of less marked parameter settings would of course not trigger do-support. Thus, virtually every response characterized by nonmovement is also a response in which there is no do-support. Table 5 shows that do-support errors were made by all three ***deaf*** groups.

The percentages of errors involving confusion between who and whose, as in (16d) above, increased as a function of decreasing proficiency level, as seen from Table 5. ***Deaf*** students' difficulty with possessive morphology is to be expected in light of Wilbur, Montanelli, and Quigley (1976), who found that ***deaf*** children and adolescents had less knowledge of possessive pronouns than of subject and object pronouns. They also found that knowledge of possessive forms increased with age. In the present study, where the ***deaf*** groups were equivalent in age, general English proficiency level appears to predict success with possessive morphology (see also below).

The percentages of nontarget question errors as in (16e) also increased as proficiency level decreased (Table 5). In virtually every instance, a nontarget question represented a less marked structure than the target structure as in (16e), where a question formed on matrix subject position is produced instead of one formed on matrix direct object position. The category of other/multiple errors, illustrated in (16f), includes error types other than those listed in (16a-e) as well as multiple instances of error types (16a-e) within a single response. Both nontarget questions and other/multiple errors increased with decreasing English proficiency level.

Error patterns. The percentages of the more common errors made on the QF task--no movement, do-support errors, nontarget questions, and other/multiple errors--are provided in Table 6 for each ***deaf*** group according to the positions defined by the wh-movement parameter (7). Each percentage reflects the ratio of errors for each position to the total number of responses associated with that position. In general, percentages tended to increase in the direction predicted by the markedness hierarchy associated with the wh-movement parameter for each error type. However, as seen from the table, the student groups differed in the patterns associated with specific errors.

For example, with respect to do-support, whereas the High and Mid Michigan groups made increasingly higher percentages of errors as embeddedness increases, the Low Michigan group made the highest percentage of errors on matrix subject position. This pattern is likely due to the fact that the Low Michigan students, with little knowledge of the marked phenomenon of do-support, are nevertheless aware of the presence of do in wh-questions and overextend its use to a certain extent in forming matrix subject questions. Recall also that their percentages refer to formations in which do-support errors are the only errors in those responses; other do-support errors are concealed in their other/multiple error category (see below). With respect to nontarget questions, the Mid and Low Michigan groups produced such structures even for questions targeting matrix subject position, which reflects the unmarked parameter value. This pattern is explained by the fact that, in virtually all of these instances, students produced matrix subject questions using the simple wh-phrase who instead of matrix subject questions targeting a complex wh-phrase containing whose. Thus, they were avoiding the greater morphological complexity of possessive wh-phrases even though both types of formation are associated with the unmarked parameter value (7a). With respect to other/multiple errors, whereas the High and Mid groups made the greatest percentage of errors on the questions targeting the most marked embedded positions, the Low group made a high percentage of errors on both the matrix nonsubject and embedded positions, that is, on all of the movement positions associated with the most marked parameter value (7c).

Other/multiple errors. With respect to the category of other/multiple errors, multiple errors involved two or more occurrences of error types listed in Table 5. Sample multiple-error responses are illustrated in (17).

> (17) a. Whose Mary said gave the bomb to the soldier? b. The sister invited who roommate to the party?

The target question for (17a) is Who did Mary say gave the bomb to the soldier?; thus (17a) contains a who/whose confusion error and a no do-support error. Relative to the target question Whose roommate did the sister invite to the party?, (17b) contains a who/whose confusion error and a no movement error.

An examination of student responses categorized as other/multiple errors revealed, in addition to multiple errors, a variety of other incorrect question formations as in the sample illustrated in (18).

(18)

a. Whose did the secretary punch lawyer in the nose?

b. Who did Diane assume the money was stolen from the banker?

c. Whose classmate lent the pencil to the man, said Susan?

In the case of (18a), for which the correct target is Whose lawyer did the secretary punch in the nose?, the question is formed properly except for the fact that the wh-word is moved to the Spec of CP position whereas the head noun of the wh-phrase remains in place. Although such structures are ungrammatical in English, they are permitted in certain other languages, for example, Russian (Avrutin, 1994), and are therefore licensed by UG. Thus a legitimate, but non-English, strategy for some students was to carry out partial wh-movement and to leave the head noun in its underlying argument position. Other structures like (18b), for which the correct target is Who did Diane assume stole the money from the banker?, simply resulted in ungrammatical formations not licensed in any grammar. In this case, there is no available argument position to associate with the wh-phrase. The formation in (18c) illustrates a common means of avoiding wh-movement from embedded positions through the use of a parenthetical phrase (said Susan). The target question is Whose classmate did Susan say lent the pencil to the man? Such parenthetical phrases are typically employed in Russian instead of structures that would require extraction of a wh-phrase form an embedded clause (Maria Shustorovich, personal communication). Again, some students were using a legitimate, but non-English, structure to avoid marked target structures.

The High, Mid, and Low Michigan groups produced a total of 61,203, and 445 questions containing other/multiple errors, respectively. Table 7 lists the percentages of other/ multiple errors by type for each group. For all responses containing other/multiple errors, specific error types in Table 7 were tallied separately from other error types that might occur in the same sentences. Thus, the total number of other/multiple errors is greater than the number of sentences containing other/multiple errors. Furthermore, percentages are based on only those structures for which that particular error type could occur. For example, the no movement percentages are calculated for the 50 task items (those targeting matrix nonsubject and embedded positions) on which a nonmovement structure is a possible response, whereas the single-clause percentages are calculated for the 30 task items (those targeting embedded positions) on which a two-clause target might be reduced to a single-clause response.

The first three error types in Table 7 are the same as three categories that appear in Table 5. The category of other structural errors includes formations like (18a) and (18b) as well as any other structural anomalies, such as the omission of a required preposition or other major constituent. Single-clause errors include responses like (18c) that avoid embedded clauses through the use of a parenthetical clause (e.g., said Susan) for what would otherwise be a higher matrix clause.

The general increase in the first three error types as proficiency level decreases helps to the clarify Table 5 percentages. For example, it is now clear that the greatest incidence of nonmovement on the QF task occurred in the responses of the Low Michigan group. Table 7 shows that the two additional error types, her structural and single-clause errors, also increased as proficiency level decreases. Thus, most of the specific error types produced on the QF task increased as overall English language proficiency decreases. Moreover, these specific error types for the most part represent less marked alternative structures to the targeted wh-question structures associated with the marked English value of the wh-movement parameter and with the marked English value associated with the doubly filled Comp filter. Importantly, this analysis of question formation errors reveals that most of the errors produced by the ***deaf*** students in this study were t haphazard and unprincipled but instead reflected principled alternatives sanctioned by UG, observed acquisitional stages, and various strategies for avoiding marked structures.

GENERAL DISCUSSION

Collectively, the results of the QF analysis, the GJ analysis, and the production error analysis provide generally strong support for learnability predictions A-E for the acquisition of English wh-questions. Specifically, the results strongly supported Prediction A, which stated that ***deaf*** learners' knowledge of English wh-question formation would improve as a function of overall English language proficiency. The results also supported Prediction B, which stated that ***deaf*** learners of English would exhibit superior performance on wh-questions targeting matrix subject position, regardless of English proficiency level. Prediction C, that *deaf* learners with low overall English language proficiency would exhibit little knowledge of wh-questions involving movement, and Prediction D, that ***deaf*** learners with somewhat higher overall English language proficiency would exhibit greater knowledge of wh-questions targeting matrix NP positions than wh-questions targeting embedded NP positions, were also generally supported by the results.

Interestingly, Prediction E[sub 1] was supported by the results of the QF analysis, and competing Prediction E[sub 2] was supported by the results of the GJ analysis. Prediction E[sub 1] stated that ***deaf*** learners of English would exhibit greater knowledge of wh-questions targeting simple, nonpossessive NPs, whereas Prediction E[sub 2] stated that *deaf learners* of English would exhibit greater knowledge of wh-questions targeting possessive NPs. This disparity in results was explained by the fact that the morphological complexity of the wh-phrase is a significant factor in the production of wh-questions, whereas the presence of an explicit lexical noun in a wh-phrase facilitates the recognition of grammaticality because it might be easier to associate the complex wh-phrase with the argument position from which it has moved.

Confirmation of Predictions A-D provides empirical support for the proposed wh-movement parameter. In conformity with the subset principle, the unmarked value (7a) involving no overt wh-movement was predicted to be the easiest to learn; the more marked value (7b) involving either no movement or movement out of a matrix clause was predicted to be harder to learn; and the most marked value (7c)--the English value--involving no movement, movement out of a matrix clause, or movement out of an embedded clause was predicted to be the hardest to learn. Confirmation of Predictions A-D also provides empirical support for Weinberg's (1990) analysis of subject-auxiliary inversion as a marked parametric option of UG. Weinberg argued that, with the exception of wh-questions targeting matrix subject position, English wh-questions constitute a marked violation of the otherwise unmarked application of the doubly filled Comp filter.

The patterns of ***deaf*** learner performance on the QF and GJ tasks, as well as their production errors, reveal that a severe restriction of spoken language input in early life can result in the acquisition of UG parameter values that are less marked than the values of the target language. Some ***deaf*** learners are not able to internalize a sufficient amount of English language input to arrive at the marked values and have grammars characterized by unmarked parameter values; others appear to internalize enough input to approximate intermediate values; and still others successfully internalize sufficient input to arrive at the marked values. The results of this study, along with the results of Berent and Samar (1990), provide strong empirical support for the subset principle .

Wexler (1993) maintained that, in addition to the explanatory power of the subset principle for language acquisition, markedness hierarchies derived from the subset principle provide predictions for acquisition orders. However, he cautioned that these acquisition orders might not often be observed in developmental data because children might pass through stages quickly or even instantly if the relevant input data is available. The results of the present study demonstrate that, under the exceptional circumstance of severely restricted spoken language input available to ***deaf*** learners, acquisition orders are indeed observable in Nays that they may not be for hearing language learners. Thus, in addition to the importance of such results for understanding the English language acquisition of ***deaf*** learners specifically, they can offer valuable insights into the mechanisms of language acquisition generally, because the English grammatical development of some ***deaf*** learners appears to be frozen at certain stages and clearly observable.

One final point needs to be made with respect to the higher sign language skills of the Low Michigan group (Table 1). With superior performance on wh-questions targeting matrix subject position following Prediction B and with little knowledge of wh-questions involving movement following Prediction C, the Low Michigan group would appear to have grammars of English characterized by the unmarked value (7a) of the wh-movement parameter. One might ask whether these students' knowledge of ASL might be transferring to their knowledge of English. Recall, however, that ASL allows movement out of matrix clauses (Lillo-Martin, 1990) and therefore has value (7b) of the wh-movement parameter. If transfer effects explained these students' knowledge of English wh-questions, then they would be expected to have parameter value (7b), which they do not. Furthermore, even if ASL had value (7a), the Low Michigan students, despite their higher sign-language proficiency, have two hearing parents as do all the *deaf* students who participated in this study. Thus they would not be considered native users of ASL. Accordingly, sign language ability cannot be invoked to provide an alternative explanation to the performance of the Low Michigan group.

CONCLUSION

In the present article, the markedness properties of English wh-questions were investigated in a learnability study involving prelingually ***deaf*** college students at three levels of English language proficiency along with a control group of college-level hearing native speakers of English. An analysis of English wh-question formation was discussed in the context of GB theory (Chomsky, 1981, 1986) and an associated theory of learnability that proposes the subset principle as a determinant of language acquisition for UG parameters whose values define languages that are ordered as proper subsets (Berwick, 1985; Wexler & Manzini, 1987). The results revealed that, despite years of exposure to English language input, many ***deaf*** learners have not internalized the positive evidence required to reset the parameters associated with English wh-question formation to their appropriate marked values.[8]

The results provide support for the theoretical proposals developed within the GB framework in that principles, parameters, categories, and constructs developed within the theory provide a formal context for the development of a plausible account of the acquisition of wh-questions and for the testing of specific theory-internal proposals. Moreover, the results demonstrate the applicability of GB theory to matters of language learning and use under special circumstances. A great deal of language-acquisition research is now conducted within GB theory, with significant progress being made toward a greater understanding of the mechanisms of language acquisition. An extension of that research to exceptional language learning, including language acquisition by ***deaf*** learners, is desirable not only to gain insight into acquisition by exceptional learners, but also to compare them with other language learners and to inform language-acquisition research generally. This study might very well have been conducted within some other theoretical framework with an adequate explanation of the results. The major significance of this study is that the results provide empirical support for the explanatory adequacy of the subset principle. Any alternative linguistic theory incorporating the subset principle as a learning mechanism for acquisition based on positive linguistic evidence would no doubt have yielded similar support for the subset principle.

With respect to the educational implications of this study, the consequences of low proficiency in English syntax for ***deaf*** college students have been discussed in Berent (1993), It was noted there that, although

deaf students do continue to make significant gains in English syntax at the college level, these gains often do not afford them access to certain degree options and are not large enough to halt attrition linked to low English skills. The results of the present study provide the specifics of yet another domain of English syntactic knowledge that causes difficulty for many ***deaf*** college students. Clearly, the ability to pose and respond appropriately to English questions and to process and produce them in reading and writing is necessary for success in a college environment.[9]

This study assessed students' abilities to produce wh-questions by converting statements to questions and to judge the grammaticality of wh-questions. Further research should assess students' abilities to produce wh-questions spontaneously and their abilities to comprehend wh-questions both in isolation and in context. ***Deaf*** learners' acquisition of wh-questions containing auxiliary verbs other than do also needs to be investigated. In general, more research into the intricacies of ***deaf*** learners' English language knowledge is needed, including research seeking more effective English teaching methods and materials that will enable ***deaf*** students to achieve their greatest educational potential in light of English language difficulties such as those posed by the phenomena explored in this study.

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1 The subset principle guarantees that learners will never overgeneralize to a larger language from which they could not retreat (Berwick, 1985).

2 Many of the GB notions discussed in this article (for example, traces, government, c-command, etc.), as well as examples of various UG parameters, are outlined in the Leonard and Loeb (1988) tutorial. This article follows the barriers model of phrase structure (Chomsky, 1986), where CP is roughly equivalent to S' and IP is roughly equivalent to S of Chomsky (1981). The constituents noted with a prime ('} are intermediate levels of projection. If (3) is represented in a tree diagram, for example, CP dominates Spec (= who) and C'; C' dominates C (= did) and IP; IP dominates the subject NP (the director} and 1'; and I' dominates 1(= t[sub in and VP. In (3b), who c-commands all constituents to its right, as does did.

3 The focus of this study is exclusively on the acquisition of wh-movement from argument (subject, object, etc.) positions involved in who questions. There are independent constraints and considerations with respect to adjunct positions involved in when, where, why, and how questions (see de Villiers, Roeper, & Vainikka, 1990).

With respect to movement possibilities generally, de Villiars et al. characterized wh-movement in terms of two parameters: one according to which a wh-phrase (a) occurs only in situ (i.e., in its logical underlying argument position) or (b) moves; and a second parameter according to which a wh-phrase (a) moves locally or (b) moves long-distance or locally. The net effect is the same as stated in (7).

4 The functions are not always as distinct as illustrated here. As Roeper and de Villiers (1992) noted (p. 194, fn. 6), "echo-questions and echo-like questions sometimes occur with reference to a vague preceding discussion: 'Now you are going where for vacation?'"

5 Abney proposed that a noun phrase is not an NP headed by a noun (N), as conventionally assumed (e.g., Chomsky, 1981), but that it is a determiner phrase (OP) headed by a determiner (D) such as an article or demonstrative pronoun. The OP can take an NP as its complement, or it can take an adjective phrase (AP) complement, which in turn takes an NP complement. Under the conventional analysis, the noun phrase the red book has the structure shown in (i); under the OP-analysis it has the structure shown in (ii).

(i) [NP [D the] [N I [AP red] [N book]]]
(ii) [DP [D the] [AP [A red] [NP [N book]]]]]

The fundamental difference between these two representations is that, in (i), the determiner and adjective are contained within NP but, in (ii), NP is contained within AP, which is contained within OP.

6 Children learning English often do not begin producing wh-questions with subject-auxiliary inversion until age 3. Thus, Weinberg (1990) noted that considerable input is required before children move from the unmarked assumption that the doubly filled Comp filter holds in matrix clauses to the knowledge that it is violated in the form of wh-movement along with subject-auxiliary inversion.

7 Possessive resumptive pronouns are somewhat more acceptable in relative clauses, which also involve wh-movement: I saw that guy who we were just talking about his sister. Such structures are common in nonstandard varieties of English.

8 Quigley, Wilbur, and Montanelli (1974) provided data on the development of English questions in prelingually ***deaf*** children and adolescents. Their study revealed gradual improvement in knowledge with increasing age but considerably deficient knowledge of English questions even by age 18.

9 LaSasso (1990) emphasized the importance of the ability to ask and answer questions, including wh-questions, to both formal and informal learning. She pointed out the challenge that English question forms present to ***deaf*** students and offered strategies that parents and teachers might use in assessing and facilitating ***deaf*** students' comprehension of questions.

TABLE 1. Means (and standard deviations) for background characteristics of the three ***deaf*** student groups.

Legend for Chart:

A - Group
B Michigan [a]
C Age
D PTA [b]
E Sign Language[c]
F Reading[d]

	B	D
	C	F
	E	
High (n=13)	84.0 (3.4)	94.5 (11.3)
	19.4 (0.8)	10.3 (1.3)
	2.8 (1.5)	
Mid (n=15)	67.6 (3.2)	100.7 (12.5)
	20.4 (2.4)	8.7 (1.0)
	3.5 (1.3)	
Low (n=18)	48.6 (4.3)	97.8 (8.5)
	20.1 (1.8)	7.0 (1.0)
	4.5 (0.5)	

a Scores, on a 100-point scale, on the Michigan Test of English Language Proficiency (English Language Institute, 1977).

b Pure tone average hearing loss measured in the better ear at 500 Hz, 1000 Hz, and 2000 Hz (International Standards Organization, 1975).

c Measured by the Sign Instruction Placement Interview (Caccamise, Armour, & Burfield, 1984), a sign language skill assessment instrument for students. Scores range from 1, no knowledge of sign language, to 5, high proficiency in sign language. d Measured by the reading subtest of the California Achievement Tests (Tiegs & Clark, 1963). Reading scores correspond to approximate grade levels.

TABLE 2. Target structures on the question formation and grammaticality judgment tasks.

Questions	Words per sentence
GRAMMATICAL QUESTIONS	
Matrix positions	
1. Who gave the bomb to the soldier?	7
2. Who did the wife leave on the road?	8
3. Who did the boy pour the milk on?	8
4. Whose manager received the present from the salesman?	8
5. Whose lawyer did the secretary punch in the nose?	9
6. Whose patient did the girl set the glass near?	9
Embedded positions	
7. Who did Mary say gave the bomb to the soldier?	10
8. Who did Judy dream the wife left on the road?	10
9. Who does Kathy think the boy poured the milk on?	10
10. Whose manager does Alison hope received the present from the salesman?	11
11. Whose lawyer does Diane assume the secretary punched in the nose?	11
12. Whose patient did Jennifer say the girl set the glass near ?	11
UNGRAMMATICAL QUESTIONS	
Matrix positions	
1. Who he gave the bomb to the soldier?	8

2.	Who did the wife leave him on the road?	9
3.	Who did the boy pour the milk on him?	9
4.	Who his manager received the present from the salesman?	9
5.	Who did the secretary punch his lawyer in the nose?	10
6.	Who did the girl set the glass near his patient?	10
7.	Who did Mary say he gave the bomb to the soldier?	11
8.	Who did Judy dream the wife left him on the road?	11
9.	Who does Kathy think the boy poured the milk on him?	11
10.	Who does Alison hope his manager received the present from the salesman?	12
11.	Who does Diane assume the secretary punched his lawyer in the nose?	12
12.	Who did Jennifer say the girl set the glass near his patient?	12

TABLE 3. Significant main effects and interactions in the question formation ANOVA.

Main effect/interaction	F	df
Group	12.77[c]	2, 43
Wh-phrase	8.93 [b]	1, 43
Clause	109.06 [c]	1, 43
position	13.65[c]	2, 42
Clause x position	55.34 [c]	2, 42
Group x Position	3.14 [a]	4, 82

[a] p<.05,[b] p< .01, [c] p < .001.

TABLE 4. Significant main effects and interactions in the grammaticality judgment ANOVA.

Main effect/interaction	F	df
Group	12.77[c]	2, 43
Group	18.34[c]	2, 43
Grammaticality	18.01[c]	1, 43
Clause	54.77[c]	1, 43
position	4.30 [a]	2, 42
Grammaticality x Wh-phrase	16.94 [b]	1, 43
Grammaticality x position	3.87 [a]	2, 42
Group x Position	4.01 [b]	4, 82
Clause x Position	21.79[c]	2, 42
Clause x Wh-phrase	4.93 [a]	1, 43
Group x Grammaticality x Position	2.82 [a]	4, 82
Clause x Wh-phrase x Position	6.26[b]	2, 42

[a] p< .05, [b] p< 0.1, [c] p < .001.

TABLE 5. Percentages of correct wh-questions and errors by type on the question formation task.

	Group			
Response Type	Hearing	High	Mid	Low
Correct	92.6	66.9	53.8	24.8
No movement	3.7	14.1	6.4	14.7
Resumptive pronoun	0.0	0.1	0.4	0.0
Do-support errors	0.0	4.4	8.2	3.9
Who/whose confusion	0.2	0.1	2.3	6.2
Nontarget question	3.0	4.4	7.3	8.7
Other/multiple errors	0.5	10.0	21. 6	41.7

TABLE 6. Percentages of four error types by group on the question formation task calculated for the positions associated with wh-movement parameter values.

	Group		
Error Type	High	Mid	Low
No movement			
Matrix Subject	0.0	0.0	0.0
Matrix Nonsubject	16.2	5.0	16.2
Embedded	16.9	4.2	20.4
Do-support errors			
Matrix Subject	0.0	6.9	8.2
Matrix Nonsubject	5.9	9.6	4.1
Embedded	6.4	10.3	2.9
Nontarget question			
Matrix Subject	0.0	3.8	6.4
Matrix Nonsubject	4.5	9.6	8.7
Embedded	6.4	7.4	10.0
Other/multiple errors			
Matrix Subject	1.8	2.3	8.8
Matrix Nonsubject	4.5	8.1	46.8
Embedded	13.6	31.0	51.8

TABLE 7. Percentages of other/multiple error types by group on the question formation task as ratios of errors to potential errors for each type.

	Group		
Error Type	High	Mid	Low
No movement	6.2	2.7	33.3
Do-support errors	0.5	8.4	15.0
Who/whose confusion	0.8	2.3	13.8
Other structural	6.2	18.7	30.8
Single clause	4.4	19.6	24.8

DIAGRAM: FIGURE 1. Learnability predictions by Michigan group reflected in the Group x Clause x Position interaction (p = .068) in the question formation ANOVA (Subj = subject, DirObj = direct object, ObjPrep = object of preposition).

DIAGRAM: FIGURE 2. Performance by Michigan group on grammatical (+GR) and ungrammatical (-GR) questions as reflected in the Group x Grammaticality x Position interaction in the grammaticality judgment ANOVA.

DIAGRAM: FIGURE 3. Overall performance on questions targeting simple and possessive wh-phrases as reflected in the Clause x Wh-phrase x Position interaction in the grammaticality judgment ANOVA.

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Abstract: Reports on the development of a scale to measure hearing adults' beliefs about the capabilities of ***deaf*** adults. List of misconceptions about ***deaf*** people; Statistical treatment of the scale; Correlation with other factors; Reliability of the scale to measure hearing adults' beliefs about the capabilities of ***deaf*** adults in various settings.

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Best Part

THE DEVELOPMENT OF THE OPINIONS ABOUT *DEAF* PEOPLE SCALE: A SCALE TO MEASURE HEARING ADULTS' BELIEFS ABOUT THE CAPABILITIES OF *DEAF* ADULTS

This report documents the development of a scale to measure hearing adults' beliefs about the capabilities of ***deaf*** adults. An item pool created from a list of misconceptions about ***deaf*** people was used to develop a 35-item Opinions About ***Deaf*** People scale, piloted with 38 university undergraduates. A revised 20-item version of the scale was piloted with 290 undergraduates. A coefficient alpha of .83 was obtained from the second pilot, with item-total correlations ranging from .22 to .58. Factor analysis demonstrated a General *Deaf* Capabilities factor (eigenvalue = 5.39). Some items also correlated moderately to strongly with an Intelligence factor (eigenvalue = 1.70). Construct validity was established through correlation with Cowen's Attitudes to Deafness scale (r = .75). Analysis supports that a reliable and valid scale has been developed that can be used to measure hearing adults' beliefs about the capabilities of ***deaf*** adults in education, employment, and other appropriate settings.

Although federal legislation mandates that equal employment and educational opportunities must be granted to ***deaf*** Americans (Americans with Disabilities Act of 1990; Nondiscrimination on the Basis of Handicap, 1991; Rehabilitation Act of 1973, Section 504), attitudinal barriers preventing such opportunities still exist (Beaudry & Hetu, 1990; Berkay, 1991; Strong & Shaver, 1991). Researchers have suggested that to remove effectively such barriers, the attitudes of hearing individuals toward heating-impaired people should be measured in order to assess attitudes that are maladaptive or open to revision (Beaudry & Hetu, 1990; Berkay, Gardner, & Smith, 1994; Schroedel & Schiff, 1972; Strong & Shaver, 1991). The purpose of this report was to document the development of an instrument to assess hearing adults' beliefs about the capabilities of ***deaf*** adults. When diagnosing attitudinal barriers that might prevent opportunities for hearing-impaired individuals, we believe that a scale specifically measuring beliefs about the capabilities of ***deaf*** adults is more helpful than one measuring general attitudes toward deafness.

A review of the literature failed to uncover a published scale that specifically measures beliefs of hearing adults about the capabilities of ***deaf*** adults. In fact, we found that there was only one widely used scale developed to measure general attitudes toward deafness: the Attitudes to Deafness (AT D) scale (Cowen, Bobrove, Rockway, & Stevenson, 1967). One reason for the widespread use of the A TO scale has been its extensive and thorough development and validation process (Beaudry & Hetu, 1990; Strong & Shaver, 1991). The ATD scale has been criticized, however, for having items with low item-total correlations and for the developers' failure to conduct a factor analysis (Beaudry & Hetu,1990). It has also been criticized because more than half of the items in the ATD's original item pool was adapted from the Attitude to Blindness scale (Cowen, Underberg, & Verrillo, 1958).

In addition to the ATD, researchers have developed two instruments to measure attitudes toward deafness that were adapted from instruments originally constructed to measure attitudes toward other disabilities. The original instruments were Siller, Ferguson, Holland, and Vann's (1967, 1968) Disability Factor Scales (DFS) and Yuker, Block, and Campbell's (1960) Attitudes Toward Disabled Persons (ATDP) scale. Through an extensive development process, a Deafness (DFS:D) scale was adapted from the original DFS scales (Beaudry & Hetu, 1990; Ferguson, 1970; Schroedel & Schiff, 1972). The ATOP scale also was adapted to measure attitudes toward deafness (Furnham & Lane, 1984; Furnham & Pendred, 1983).

For many items in both the DFS:D and the ***deaf*** version of the ATOP, those authors merely replaced the phrase "disabled person" in the original instruments (or a phrase for another disability, such as *"blind* person") with *"**deaf*** *person."* They also added new items that related directly to ***deaf*** people. Beaudry and Hetu (1990) discussed their concern that reliability and validity studies from scales developed for general attitudes toward disabled persons could not be generalized to studies that adapted these scales to measure attitudes toward deafness, especially when additional items were added to the original scales.

To avoid some of the problems with these three existing scales, the entire item pool for the scale in the current study was based upon a review of the literature on deafness rather than on items from any existing instruments developed to measure attitudes toward other disabilities. The previous development process used by past researchers was not used here because we were concerned that items developed for other disabilities might not focus on important attitudes regarding the unique characteristics of ***deaf*** people. Therefore, the substitution of the words *"**deaf*** or "deafness" into existing items developed for general disabilities or other specific disabilities was not considered. We also avoided some of the limitations of the ATD scale by conducting a factor analysis and removing items with low item-total correlations.

The specific purpose of this investigation was to examine the psychometric properties of a newly constructed scale to measure hearing adults' beliefs about the capabilities of ***deaf*** adults including (a) the reliability of the scale, (b) the factor structure, and (c) construct validity.

Method

The Construct

The instrument was developed to assess hearing adults' beliefs about the capabilities of ***deaf*** adults. Because subjects often use themselves as flames of reference when making judgments about others (Nunnally, 1978), beliefs about these capabilities were determined by comparing ***deaf*** people's capabilities to hearing people's capabilities. We conceptualized this construct as a continuum between two extreme types of hearing individuals: those who believe that ***deaf*** people are equally as capable as hearing people and those who believe that ***deaf*** people are less capable than hearing people. (We realize that many people's beliefs are not consistent across all contexts. Many individuals may believe that ***deaf*** people are capable in some areas and not in others.)

It is assumed that a hearing adult who believes that ***deaf*** adults have equal capabilities would also believe that *deaf* people possess the same intelligence and skill level as hearing people, with the exception of the ability to process verbal language and to hear. A hearing person who believes in equal capabilities would be aware that there are many low-functioning ***deaf*** people who possess low intelligence and abilities, but that there are also many low-functioning hearing people in the same situation. More specifically, aspects of the "equal capability" belief were identified from the literature as follows:

> 1. A belief that the normal distribution of intelligence within the ***deaf*** population is comparable to the distribution of intelligence within the hearing population (Nester, 1984).
>
> 2. A belief that ***deaf*** people possess the ability to (a) take care of themselves and live independently (Oklahoma Department of Human Services, 1993); (b) gain and maintain employment in either blue or white-collar occupations, depending on their qualifications (Decaro, 1981); (c) drive safely on public roads (Baker & Cokely, 1980); (d) perform academically on a comparable level with their hearing peers (Culton, 1975; Murphy, 1976); and (e) find ways to communicate with hearing people, even when an interpreter is not present (Foster, 1987).

Development of the Opinions About *Deaf* People Scale

In order to determine the most common misconceptions that hearing people have about the capabilities of ***deaf*** adults, a review of the literature was conducted. In addition, six ***deaf*** professionals were interviewed to obtain anecdotal information about such misconceptions. The misconceptions that were mentioned fell within the following categories: (a) intelligence, (b) dealing with traffic, (c) job skills, (d) independent living, (e) communication skills, and (f) academic skills. The goal was to develop a univariate scale that adequately reflected as broad a range of misconceptions as possible. In order to achieve this, blueprints were designed so that all of these categories would be adequately represented in both a 35-item pilot scale and a 20-item revised scale. Using the blueprint as a guideline, the writers developed the 35-item Opinions About ***Deaf*** People (ODP) scale for an initial pilot study. A 4-point Likert scale was used with this instrument in order to avoid a neutral point, which might allow subjects to avoid committing to an attitude (Nunnally, 1978).

This 35-item scale was reviewed by measurement specialists, as well as by those in the field of ***deaf*** education. Minor revisions were then made prior to conducting the first pilot. The initial pilot study using the 35-item scale was conducted with 38 students enrolled in an undergraduate course in a teacher education program at a southwestern university. We revised the 35-item instrument to obtain a 20-item version by discarding 15 items based on low item-total score reliability estimates, low main factor correlations, and lack of conformity with blueprint requirements.

A second pilot investigation was conducted using the revised 20-item scale with 290 subjects from two sections of an upper-division, general education sociology course at a southwestern university. To perform construct validity analysis, each subject also responded to Cowen's 25-item ATD scale (Cowen et al., 1967) following the administration of the ODP scale. To avoid revealing that bias was being measured, subjects were simply informed that the ODP scale was asking for their opinions about ***deaf*** people. No mention was made about the examination of misconceptions about ***deaf*** adults' capabilities until a debriefing session that followed.

Sample

A total of 299 students (123 males, 173 females, and 3 gender unreported) agreed to participate in the second pilot study. Nine subjects' surveys were eliminated from the data analysis because of multiple responses on one or more scale items (n = 3) or failure to complete all scale items (n = 6). The remaining

290 subjects (120 males, 167 females, and 3 gender unreported; ages 18 to 50) became the sample. Demographics were reported on a background information sheet completed by each subject. A review of the descriptive statistics on the background data revealed that the majority of the subjects were college seniors (42%). The rest of the subjects consisted primarily of juniors (34%) and sophomores (21%). The remaining 3% consisted of either freshmen, master's students, or those who failed to report their class level. A total of 69% of the subjects were Caucasian, whereas the remainder reported membership in a number of other ethnic categories.

It may be of interest to note that only a few of the subjects had ***deaf*** relatives or family members (9%). A larger portion of subjects, however, had had experience with ***deaf*** classmates (29%) and/or ***deaf*** coworkers (13%). Because these participants were in a course that is a general education requirement, the sample appeared to be representative of a typical undergraduate student population. Although most of the subjects were from the College of Arts and Sciences (53%), there were also students from most of the other colleges, including Allied Health (22%), Business Administration (9%), and Engineering (7%).

Data Analysis

A reliability analysis using a covariance matrix was employed to determine Cronbach's alpha, Guttman's split-half coefficient, and item-total score correlations for the ODP scale. A Pearson product-moment correlation with a one-tailed probability was calculated to determine the relationship between the ODP scale and Cowen's ATO scale (Cowen et al., 1967). A principal components analysis without iteration and a varimax rotation using Kaiser Normalization was used to extract factors with eigenvalues of 1.00 or more. Those factors with eigenvalues less than 1.00 were eliminated from the final analysis with this method.

Results

Descriptive Statistics

There are 20 items in this scale. Responses to each item were scored from one to four points, with a negative attitude receiving the highest score. Because this is a summative scale, each subject's score was calculated by adding up the points for all 20 items. The possible range of scores was from 20 to 80. A low score reflected a positive attitude about the capabilities of ***deaf*** adults, whereas a high score reflected a negative attitude. The mean total score for the second pilot investigation of the OOP scale was 30.31 with a standard deviation of 6.76. The range of scores was 20 to 53. The skewness was .85 and the kurtosis was .32. The standard error of measurement for this scale was 2.81 with a 95% confidence interval of +/- 5.51.

Reliability and Validity

SPSS: Statistical Package for the Social Sciences (Nie, Hull, Jenkins, Steinbrenner, & Bent, 1975) was used for all data analysis procedures in this study. For the second pilot study, the coefficient alpha was calculated to be .83, and a split-half reliability of .82 was obtained. Item-total score correlations ranged from .22 to .58. Only three item-total score correlations were below .30. To support statements of the presence of construct validity, Cowen's A TO scale (Cowen et al., 1967) was administered following the administration of our scale. The OOP scale was correlated with Cowen's scale at .75 ($p < .001$), which accounted for approximately 56% of the variance of scores on one scale by scores on the other. A higher correlation was not expected because the OOP scale was designed to measure beliefs about ***deaf*** capabilities, whereas the A TO scale measures general attitudes toward deafness.

Factor Analysis

A principal components analysis without iteration and a varimax rotation was employed to perform the factor analysis of the intercorrelations of items from the second pilot study of the ODP scale. Although six factors with eigenvalues greater than 1.00 (accounting for 58% of the variance) were revealed, only one had an eigenvalue over 2.00. Factor 1 was the most explanatory one with an eigenvalue of 5.39, which accounted for 26.9% of the variance of the scores in the scale. (The item-factor and item-total correlations for Factor 1 are shown in Table 1.) An examination of the factor matrix revealed that the majority of the items were correlated moderately to strongly with Factor 1, with item-factor correlations ranging from .25 to .67. Only Item 2 produced a correlation of less than .30 with this factor. Factors 2,3,4,5, and 6 had eigenvalues of 1.7 (8.5% of the variance), 1.33 (6.6%), 1.10 (5.5%), 1.07 (5.4%), and 1.01 (5.1 %), respectively.

We examined the six items that were correlated the highest with a factor other than Factor 1. These items were examined for different themes. The following results were notable:

1. Items 17 and 18 were correlated the highest with Factor 2 (with correlations of .72 and .68, respectively), but also were correlated with Factor 1 (.34 and .48). Both items were related to intelligence of ***deaf*** people. Although correlating higher with Factor 1 (.55), Item 5 also correlated moderately with Factor 2 (.38). This item was also related to intelligence of ***deaf*** people.

2. Item 2 was correlated with Factor 3 (.46) and with Factor I (.25). Item 19 was correlated with Factor 4 (.52) and with Factor 1 (.36). Both of these items were related to perceived danger for ***deaf*** people, based on their inability to hear. It is possible that those who believe ***deaf*** people are highly capable are concerned about placing them in what is perceived to be a potentially dangerous situation.

3. Item 9 was correlated the highest with Factor 5 (.57), but also was correlated with Factor 1 (.48). This item was related to the ability of ***deaf*** people to keep up in school. It might be possible that those hearing people who believe that ***deaf*** people are capable may have considered potential educational barriers unrelated to capabilities (e.g., lack of accommodations).

4. Item I was correlated the highest with Factor 6 (.50), but also was correlated with Factor I (.39). This item examined the relationship between good speech and the intelligence of the ***deaf*** person. Possibly, people who believe that ***deaf*** people are capable are uncertain about this relationship. Factors other than intelligence that affect speech, such as pre- versus postlingual deafness (being deafened before or after language exposure), might be unknown to these subjects. This item might measure ignorance in this area, rather than a negative attitude toward the capabilities of ***deaf*** people.

Overall, there appeared to be one General ***Deaf*** Capabilities factor (Factor 1), although a few items do also correlate strongly with a second factor, Intelligence (Factor 2). Because most of the items were correlated relatively high with Factor 1, the scale developers decided to retain that factor for this scale. The other factors were not retained.

Discussion

A reliable and valid scale has been produced for the purposes of measuring hearing adults' beliefs about the capabilities of ***deaf*** adults. Few adjustments to the original scale blueprint were needed to reduce the 35-item instrument used in the first pilot study to the desired 20-item instrument, which contained reliable and/or factor-related items. For the second pilot study, the reliability, as measured by a coefficient alpha of .83, and the concurrent validity of the scale, as measured by correlation with Cowen's scale, were judged acceptable.

One limitation to the immediate application of this instrument is related to the sample that was used for validation. The reliability and validity of this instrument can currently be generalized only to other university undergraduates. It is unclear whether the responses of this sample are representative of those of the general adult hearing population in the United States. A future validation with a more diverse sample is planned to determine the reliability and validity of the instrument for a more general population.

Several uses are suggested for this scale. In practice, the scale could be useful for analyzing the attitudes of an audience of hearing individuals. For example, the scale can be administered to a group of employees in a large corporation or in an educational setting prior to a ***deaf*** awareness workshop in order to assess general attitudes and misconceptions that need to be addressed. In such an application, the scale could also be readministered to evaluate the effectiveness of a workshop in changing beliefs about the capabilities of ***deaf*** adults.

In research, the scale could be used to investigate the relationship between attitudes toward the capabilities of ***deaf*** people and other variables. For example, the scale could be administered to graduate program admissions personnel and correlated with the percentage of ***deaf*** applicants accepted. This might determine whether a relationship existed between the beliefs of graduate admissions personnel about the capabilities of ***deaf*** adults and the admission of ***deaf*** applicants to graduate programs.

Table 1
Items Scores Correlated With Total and Factor 1

Legend for Chart:
A - Items
B - Item-total, correlation
C - Item-factor, correlation

A	**B**	**C**
1. Smarter deaf people have better speech than ***deaf*** people who are less intelligent. (-)	.31	.39
2. ***Deaf*** people drive just as safely as hearing people. (+)	.22	.25
3. A ***deaf*** person can have the leadership abilities needed to run an organization. (+)	.52	.61
4. It is unfair to limit ***deaf*** people to low-paying, unskilled jobs. (+)	.42	.52
5. A ***deaf*** person could get a Ph.D. or a Masters degree. (+)	.44	.55
6. If a boss has a problem with a ***deaf*** employee, the boss should talk with the interpreter, rather than the ***deaf*** person. (-)	.34	.41
7. A ***deaf*** person could be promoted to a management position. (+)	.54	.66
8. An 18-year-old ***deaf*** adult is capable of living alone and taking care of him - or herself. (+)	.40	.49
9. It is nearly impossible for a *deaf* person to keep up with a hearing person in school. (-)	.40	.48
10. It can be frustrating to pay a visit to ***deaf*** people because they can't hear you knock at the front door. (-)	.42	.47

11. Deaf people cost tax payers lots of money because they can’t keep their jobs. (-)	.44	.52
12. Deaf people should only work in jobs where they don't need to communicate with anyone. (-)	.58	.67
13. It is a mistake to leave a baby alone with a deaf person, because he/she can't hear the baby cry. (-)	.48	.52
14. Deaf adults must depend on their parents to make important decisions. (-)	.53	.61
15. Signing is not really a language because only simple thoughts can be communicated. (-)	.43	.52
16. A deaf person could not go to a restaurant without a hearing person, because he/she could not order food without assistance. (-)	.55	.65
17. A deaf person can be an excellent writer (+)	.24	.34
18. Deaf people are as intelligent as heating people. (+)	.38	.48
19. If them was a fire, a deaf person could get out of a building safely without help just as easily as a heating person could. (+)	.29	.36
20. Deaf adults are able to communicate with their hearing children. (+)	.57	.64

Note. (-) indicates a negative item; (+) indicates a positive item.

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Abstract: Determines whether the addition of captions to an instructional videotape or the inclusion of caption-viewing strategy instruction would affect hearing college students' comprehension of challenging, unfamiliar domain content. Declarative knowledge and intellectual skills; Alternative ways to integrate caption-viewing; Captions on college-level hearing comprehension.

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THE EFFECTS OF CAPTIONS ON DECLARATIVE KNOWLEDGE COMPREHENSION AND INTELLECTUAL SKILL ACQUISITION BY HEARING STUDENTS VIEWING A CAPTIONED PROGRAM IN, A POSTSECONDARY SETTING

ABSTRACT

The purpose of this study was to determine whether the addition of captions to an instructional videotape or the inclusion of caption-viewing strategy instruction would affect hearing college students' comprehension of challenging, unfamiliar domain content. Ninety-six preservice teachers viewed a 20-minute instructional videotape under one of four conditions: (a) traditional viewing (non-captioned), (b) captioned videotape, (c) captioned videotape following 2-minute practice of a caption-viewing strategy, and (d) captioned videotape following 10-minute practice, Participants' comprehension was subsequently measured on two levels: declarative knowledge and intellectual skills. No significant differences among conditions were observed. Neither the addition of captions to instructional videotapes nor providing caption-viewing strategy instruction affected comprehension. Discussion of alternative ways to integrate caption-viewing strategies to boost comprehension is offered. The authors propose that in the absence of detrimental effects on comprehension, attributing negative effects on comprehension when hearing students view captioned instructional videotapes appears erroneous.

While captions have been shown to be beneficial to deaf students [1-4], obstacles remain that prevent the wide-scale use of captioned instructional videotapes in mainstreamed classrooms consisting of deaf and hearing students at universities [5-10]. Recent advances in the technology of captioning have clearly reduced barriers related to the technical implementation of captioning [11-12], however, other barriers still remain. Hearing viewers and educators have expressed concern that captions are distracting to hearing audience members [710]. Negative attitudes on the part of instructors and students toward the use of captions in a mainstreamed classroom have also been expressed [8-10]. Yet these beliefs seem to be unfounded and anchored only in opinion versus empirical findings.

Several experiments have been conducted to examine the effects of captions on college-level hearing comprehension [8-10,13-14]. Reese & Davie [14] determined that college students increased comprehension performance when brief captions were present. Unfortunately, brief captions are presented at a low presentation rate (number of captioned words presented per minute), while captioned instructional videotapes typically use a medium presentation rate. So these positive results are not applicable to the use of captions in a mainstreamed setting.

In two other experiments, when the presentation rate was at a medium level or high level [8-10,13], the hearing students' comprehension did not improve with the addition of captions. Moreover, a review of these experiments revealed that the stimulus materials used consisted of current news stories and light documentaries-information most likely containing content familiar to the subjects.

Empirical findings regarding comprehension of prior domain knowledge have shown that subjects have little difficulty processing material in familiar domains, whereas non-familiar domain material can present comprehension difficulties [15-17]. Therefore, it could be suggested that the stimulus materials used in prior captioning experiments were familiar enough to the subjects to allow for near maximum comprehension without captions. There may have been only minimal gains in comprehension when the captions were added because of a ceiling effect. In order to validly measure the effects of captions on comprehension, it could be argued that a more appropriate methodology would be to present challenging material from an unfamiliar domain.

Another possible explanation for the failure to find captions beneficial in past experiments might be related to the use of an effective caption-viewing strategy. Although undocumented in the literature, experts in the captioning field revealed to us that there appears to be a difference between the caption-viewing strategy used by expert and novice caption readers (G. Freed and J. Navoy, personal communication, August 27, 1993). Skilled caption readers report that they quickly glance at the captions and then back up at the picture. The novices claim to linger on the captions for much longer periods of time, which allows little time left over to attend to the picture.

In view of this caption-reading problem, determining whether teaching an effective caption-viewing strategy would improve the caption-reading skills of hearing novice caption readers becomes important, as these improved skills might result in increased comprehension when captions are added to instructional videotapes. Such an intervention would be designed to train hearing novices how to allocate less attention to the captions and more to the picture.

The purpose of this study was to determine whether captions or caption-viewing strategy instruction affect hearing students' comprehension performance when viewing a captioned instructional videotape with unfamiliar domain content. Specific attention was directed at seeking evidence as to whether captions affect comprehension in two domains, acquisition of declarative knowledge and intellectual skills. This information could serve as a basis for recommendations regarding the use of captioned videotapes in mainstreamed or non-mainstreamed college classrooms as well as add to the existing knowledge of how captions or caption-viewing strategy instruction affect the comprehension of instructional videotapes for hearing students.

METHOD

Subjects

The subject group consisted of 90 hearing students, primarily undergraduates, enrolled in a preservice teacher preparation program at a Southwestern University located in a suburban community. Participants were voluntarily recruited from a range of upper-division undergraduate education courses. Descriptive statistics for the sample were as follows: 83% female and 17% male with an age range of 19 to 52 years and a mean age of 26 years. Elementary education majors had the highest representation in the sample (47%) followed by secondary education (22%) and early childhood education (21 %). The academic ranking of the group included 75% seniors and 16% juniors. The ethnic makeup of the sample was 89% Caucasian, 4% Asian, 3% African American, 3% Native American, and 1 % Hispanic.

Materials

Captioned videotape. In selecting an appropriate instructional videotape, three fundamental factors served as a basis for the selection of valid stimulus material: (a) the level of challenge presented by the subject matter, (b) the technical quality of the captioning, and (c) the presentation rate of the captions.

A commercially produced captioned videotape in the area of developmental psychology was located and reviewed by a panel of experts. The resulting content analysis deemed the program suitably challenging to the subject group. The stimulus material consisted of a 20-minute videotape presenting information related to the following topics: (a) prenatal development, (b) the effects of fetal alcohol syndrome, (c) cognitive capabilities of new-born babies, and (d) the brain's commitment to language. In addition, the instructional videotape also met a variety of technical criteria. The program was professionally captioned by the National Captioning Institute (NCI). The captions were produced off-line and were properly timed and placed directly under the speaker. The presentation rate was estimated to range from 150 to 180 words per minute, which is in the range of a medium presentation rate typical of most instructional videotapes. The captions were standard white on a black background.

Comprehension Measures. A criterion-referenced test was constructed to evaluate students' comprehension of the content presented in the 20-minute instructional videotape. When designing the test, a distinction was made between measuring comprehension related to the domains of declarative knowledge (the learner's ability to remember/restate information from the videotape) and intellectual skills (the learner's ability to synthesize and apply information from the videotape). A pilot version of the comprehension test was written with 51 items, which measured both declarative knowledge and intellectual skills (27 declarative knowledge and 24 intellectual skills items). Content validity of the test items was established based upon an analysis conducted by four content experts in the area of Child and Adolescent Development. Following two pilot tests, a final 23-item comprehension instrument was written, consisting of a declarative knowledge sub-test (14 items) and an intellectual skills sub-test (9 items). Items were written as multiple-choice questions with four foils each.

Design

A posttest only control group design was used to examine post-treatment differences among groups. The four treatment groups were as follows: (a) captions without instruction (captions only) (a = 25), (b) captions with instruction/short practice (short practice) (n = 18), (c) captions with instruction/long practice (long practice) (n = 21), and (d) no captions, no instruction, no practice (control) (n = 26).

Treatment Groups

Captioned program only. The captions-only group viewed the 20-minute videotape with captions. However this group did not receive any instruction regarding strategies one might use when captions are presented on screen, nor were they allowed any practice time viewing captions prior to viewing the captioned stimulus material.

Captioned program with short practice. The short-practice group was given instructions on caption-viewing strategies followed by a 2-minute practice period viewing a videotape segment similar to the stimulus material, but non-challenging in content. The purpose of this practice was to concentrate on mastering the caption-viewing strategy, rather than on learning challenging material. (The strategy mainly consisted of glancing quickly at the captions and then back up at the picture, instead of lingering on the captions and
Neglecting the picture.)

Captioned program with long practice. The long-practice group received exactly the same instructions and caption-viewing strategies as the short-practice group, but were given a longer 10-minute practice period viewing captions. In the absence of specific guidelines, 2-minute and 10-minute periods were selected, as these time lengths were judged to be substantially different.

Control group. The control group viewed the 20-minute videotape in its non-captioned format, .just as instructional videotapes are typically presented in instructional situations.

Procedures

Two experimental sessions were conducted with two treatment groups per session. During each session subjects were randomized into one of the two scheduled treatment groups upon arrival.

The experimental sessions were conducted in actual university classrooms. Each room contained student desks arranged to allow the subjects an unobstructed view of the 27" video monitor screen and close enough to allow reading of the captions. To ensure visibility of the program, taller subjects were seated in the back of the room, while shorter subjects were seated in the front of the room. Subjects were informed that they would be shown a 20-minute instructional videotape and that they would be tested on the content with a 23-item multiple choice test following the viewing. Before viewing the stimulus material, the short and long-practice groups received the prescribed treatment intervention (caption-viewing strategy instruction with short or long practice). Then the control group viewed a non-captioned version of the program, while the other three groups viewed a captioned version. They were asked not to talk during the program.

After viewing the instructional videotape, the subjects completed the 23-item criterion-referenced test. They were told that the test was not timed, and they could take as much time as they needed to complete the test. They were also asked not to discuss the items amongst themselves.

Results

For each subject, the number of correct responses for the separate declarative knowledge and intellectual skills comprehension sub-tests was calculated. Group mean proportions of correct responses were determined for each sub-test.

For the declarative knowledge sub-test, the proportions of correct responses ranged from .60 (SD = .13) for the control group to .70 (SD = .17) for the long-practice group. For the intellectual skills sub-test, the proportions correct ranged from .52 (SD = .17) for the control group to .60 (SD = .16) for the long-practice group. For both sub-tests, the control group had the lowest proportions of correct responses, while the long-practice group had the highest.

A MANOVA was used to compare the group means using the declarative knowledge and intellectual skills sub-tests as dependent variables. The differences between groups were not statistically significant for the declarative knowledge skills sub-test ($F[3, 86] = 1.74$, $p > .05$) or for the intellectual skills sub-test ($F[3, 86] = 0.69$, $P > .05$). The absence of significant differences indicates that subjects in these four groups did not perform significantly differently on either sub-test.

DISCUSSION

The four treatment groups did not generate significantly different scores on the declarative knowledge and intellectual skills comprehension sub-tests. Similar to past findings examining the effects of medium or high-presentation rate captions with hearing students [8-10,13], the addition of captions to an instructional videotape did not lead to an increase in comprehension of program content. Additionally, the caption-viewing strategy instruction and practice periods did not appear to affect these subjects. These results prompt a variety of interpretations.

Prior to conducting this experiment, we suspected that in past studies [8-10,13], comprehension gains were not achieved when captions were added because stimulus materials contained content that was either non-challenging or familiar to subjects. This may have created a ceiling effect on test performance. In order to eliminate the possibility of such a ceiling effect, this study purposefully selected stimulus material that was challenging as well as unfamiliar to the subjects. Even with this challenging stimulus material, the addition of captions still did not show an increase in the subjects' comprehension of program content. According to the between-channel redundancy (BCR) theory, when information is redundant between two information sources (e.g., captions and dialog), comprehension should be greater than when the information is presented through only one information source (e.g., dialog) [18-23]. This theoretical perspective was not supported by the results.

Unlike previous studies examining the effects of captioning on comprehension, this study also included a category of students who were provided with caption-viewing strategy instruction and practice prior to their viewing of the stimulus material. However, even with the addition of this instruction and practice time, there were no significant gains in comprehension of the program content. Possible reasons for the failure to achieve comprehension gains in this experiment can be considered. One possibility is that the subjects were not given sufficient time to become accustomed to using the caption-viewing strategy. For example, when considering the length of the practice periods offered in this experiment (2 minutes or 10 minutes of caption-viewing practice), the subjects may not have had sufficient time to achieve a level of automaticity of the caption-viewing strategy to the degree that it could be used effectively to deal with the divided attention task of simultaneously viewing captions and the picture.

Perhaps with a greater degree of practice and greater automaticity of this skill, comprehension gains might be obtained when captions are added to instructional videotapes. If this is indeed the case, how long does it take to obtain a sufficient level of automation to view captions effectively enough to boost comprehension? A more effective intervention might require several hours, rather than minutes of practice. Of course, such an intervention would be impractical for classroom use, unless captioned instructional videotapes are an extensive part of a course curriculum and shown over several class sessions. In which case several hours of practice time may be justified. However, the longitudinal experience of viewing instructional videotapes with captions inherently provides this practice time, and automaticity strategies should likely develop over time. Therefore, all that might be needed is a formal but short introduction of caption-viewing strategies at the beginning of a course, with a somewhat longer practice time (e.g., 12 to 20 minutes) and periodic reminders or prompting of the strategy over time. It appears that further research regarding the connection between having automaticity of a caption-viewing strategy and comprehension gains for hearing individuals is needed.

Finally, while this experiment failed to produce comprehension gains, this study yields evidence that the addition of captions does not diminish the comprehension of content when hearing students view unfamiliar domain instructional videotapes. In essence, there appears to be an absence of any detrimental effects to using captioned videotapes in mainstreamed college instruction. Because captions are not detrimental to the comprehension of hearing students, this should alleviate both students' and educators' concerns regarding the use of captioned videotapes in instructional settings. For example, it appears that there is no need to create or maintain separate caption-viewing facilities for deaf students and hearing students based purely upon the concern of effects on heating students' comprehension of videotape content. It also provides instructors a relative degree of comfort that using captioned videotapes as part of instruction will not have any negative effects for hearing students. Although captions do not seem to affect the acquisition of declarative knowledge or intellectual skills, the influence of captions on hearing students' attitudes and perceptions regarding their comprehension of video-based information remains a factor of interest and future study.

TABLE 1. DECLARATIVE KNOWLEDGE AND INTELLECTUAL SKILLS SUB-TEST PROPORTIONS OF CORRECT RESPONSES FOR THE CAPTIONS-ONLY, SHORT-PRACTICE, LONG-PRACTICE, AND CONTROL GROUPS

Legend for Chart:

A - Subtest
B - Captions Only (n = 25): Mean
C - Captions Only (n = 25): SD
D - Short Practice (n = 18): Mean
E - Short Practice (n = 18): SD
F - Long Practice (n = 21): Mean
G - Long Practice (n = 21): SD
H - Control (n 26): Mean
I - Control (n 26): SD

A	B	C	D	E	F	G	H	I
Dec	.65	.14	.66	.18	.70	.17	.60	.13
Int	.57	.16	.56	.26	.60	.16	.52	.17

Note: Dec= Declarative Knowledge Sub- test
Int= Intellectual Skills Sub-test

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Abstract: Presents information on a study which investigated the effects of short-term training/practice on group and individual differences in ***deaf*** and hearing speechreaders. Methodology of the study; Results and discussion on the study; Conclusions.

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ENHANCED SPEECHREADING IN *DEAF* ADULTS: CAN SHORT-TERM TRAINING/PRACTICE CLOSE THE GAP FOR HEARING ADULTS?

This study investigated effects of short-term training/practice on group and individual differences in *deaf* and hearing speechreaders. In two experiments, participants speechread sentences with feedback during training and without feedback during testing, alternating 10 times over six sessions spanning up to 5 weeks. Testing used sentence sets balanced for expected mean performance. In each experiment, participants were adults who reported good speechreading and either normal hearing (n = 8) or severe to profound hearing impairments (n = 8). The experiments were replicates, except that in one participants received vibrotactile speech stimuli in addition to visible speech during training, testing whether vibrotactile speech enhances speechreading learning. Results showed that (a) training/practice did not alter the relative performance among individuals or groups; (b) significant learning occurred when training and testing were conducted with speechreading only (although the magnitude of the effect was small); and (c) there was evidence that the vibrotactile training depressed rather than raised speechreading scores over the training period.

KEY WORDS: speechread, lipread, learning, ***deaf***, hearing, vibrotactile

Several fundamental questions have been posed in the speechreading literature concerning effects of short-term training/ practice and long-term perceptual experience on accuracy of speechreading. For example, can lifelong reliance on speechreading associated with early-onset deafness(nl) result in enhanced speechreading accuracy? Can short-term training/practice result in significant learning? Does the method of training/practice affect speechreading accuracy? Previous investigators have concluded that the necessity to rely on visible speech as a consequence of deafness does not result in any experientially based advantage for visual speech perception among ***deaf*** as opposed to hearing individuals (Clouser, 1977; Conrad, 1977; Green, 1998; Lyxell & Rannberg, 1991a, 1991b; Massaro, 1987; Mogford, 1987; Owens & Blazek, 1985; Rannberg, 1995; Summerfield, 1991; cf., Pelson & Prather, 1974; Tillberg, Rannberg, Sv Ard, & Ahlner, 1996). Furthermore, throughout the twentieth century, the clinical and educational experience involving speechreading training in children has been understood to suggest that training is not very effective in reliably producing outstanding speechreaders among young ***deaf*** children (e.g., Heider & Heider, 1940; Jeffers & Barley, 1971). An opinion held by many today is that, in both ***deaf*** and hearing populations, speechreading varies widely across individuals and that individuals' relative ability among other speechreaders is primarily an inborn trait, not one that can be affected greatly by either explicit training or need to rely on visible speech for communication.

Bernstein, Demorest, and Tucker (2000) conducted a normative study of speechreading in ***deaf*** and hearing adults. They found within their sample a large group of ***deaf*** adults with early-onset deafness who were consistently superior to all of the hearing adults in the study across a range of speechreading materials and measures. Approximately 25% of the ***deaf*** participants outperformed 100% of the hearing participants. Bernstein et al. interpreted their results as evidence that some combination of reliance on speechreading, long-term severe to profound hearing impairment, and natural talent can result in enhanced speechreading in a subset of ***deaf*** individuals. However, several questions could be raised by this interpretation. First, was the ***deaf*** group's superiority attributable to their being asked to do a task that was for them simply more familiar (as opposed to a true difference in speech perception capability)? Second, could training/practice result in substantial changes in performance in either or both of the two groups? These questions were investigated in the current study, in which short-term training/practice was given to ***deaf*** and hearing participants.

In this paper, training refers to explicit procedures intended to enhance performance. Learning refers to demonstrated enhancements in performance. The combination "training/practice" acknowledges the possibility that when learning is associated with a particular training method, the learning may not necessarily be due to the training method per se, but to something else (unidentified) that might be no more than the opportunity to repeatedly perform (i.e., practice) the speechreading task.

Effects of Short-Term Training/Practice on Speechreading

Under the implicit or explicit hypothesis that training on phoneme identification might enhance speechreading, several studies have given training with nonsense syllables (e.g., Gesi, Massaro, & Cohen, 1992; Massaro, Cohen, & Gesi, 1993; Walden, Erdman, Montgomery, Schwartz, & Prosek, 1981; Walden, Prosek, Montgomery, Scherr, & Jones, 1977). Improvements in phoneme identification have been demonstrated in participants with impaired hearing (Walden et al., 1977; Walden et al., 1981) and normal hearing (Gesi et a1., 1992; Massaro et a1., 1993). These studies did not compare ***deaf*** versus hearing participants.

Whether the training with nonsense syllables generalized to sentences was investigated by Massaro et a1. (1993), whose training and testing of hearing adults involved CV syllables, monosyllabic words, and sentences presented seven times across the experiment: once at the beginning, once after each of five courses of training, and once after a retention period of 7.5 weeks. The same stimuli were observed under conditions of audio alone, video alone, and audiovisual presentation. The sentence tests showed approximately 20 percentage point increases between the first and second sessions and little change after that. However, the 96 sentences were presented under all conditions and were almost perfectly intelligible under the audiovisual condition. Improved scores could have been due to remembering items from the high-intelligibility conditions.

Speechreading in Studies of Vibrotactile Speech Aid Training

The focus for the current study was speechreading of sentences. A substantial source of contemporary information about training to speechread sentences is in the literature on training with a vibrotactile aid. (Comprehensive reviews on vibrotactile speech aids can be found in Plant & Spens, 1995, and Summers, 1992.) Evidence that improvements in speechreading are associated with vibrotactile speech aid training was incorporated into the current study.

Because researchers have observed that learning vibrotactile speech stimuli is a slow process, in many of the studies adults were trained across a lengthy series of aided and unaided sessions/conditions. Novel isolated sentence stimuli have frequently been used. Speechreading without the vibrotactile aid has been shown to improve for isolated sentence stimuli in participants who received training with the vibrotactile aid (e.g., Bernstein et al., 1991; Boothroyd & Hnath-Chisolm, 1988; Boothroyd, Kishon-Rabin, & Waldstein, 1995; Eberhardt, Bernstein, Demorest, & Goldstein, 1990; Kishon-Rabin, Boothroyd, & Hanin, 1996; also see results for studies that used continuous discourse tracking: De Filippo, 1984; De Filippo & Scott, 1978; Weisenberger & Broadstone, 1989).

Typically, vibrotactile aid studies have not included controls who did not receive the vibrotactile aid training. One exception was Eberhardt et al. (1990), in which four different F0 vibrotactile aids were studied. Groups of three hearing adults were assigned to each of the F0 conditions or to a speechreading-only control condition. Training and testing with the vibrotactile aid involved five alternations (totaling approximately 35 hours) of aided and unaided speechreading. Controls never received vibrotactile stimuli but received the otherwise identical protocol. Statistical tests confirmed learning in the unaided test conditions for the group and, individually, in 12 out of the 15 participants, including participants in the control condition.

In another study that used unaided controls, Bernstein et al. (1991) tested three multichannel vibrotactile aids that provided spectral speech information. Adult participants were prescreened to be average or better speechreaders. Performance improved during testing and training across participants. Two ***deaf*** participants gained approximately 20 percentage points in speechreading alone. Gains were smaller in all the other participants.

Literature Summary

The literature shows that training/practice is associated with improvements in performance, and some results suggest differential effects in ***deaf*** versus hearing participants. The vibrotactile speech aid literature shows that training with a vibrotactile speech aid is associated with improved unaided speechreading performance; and in studies with visual-only controls, controls also demonstrated improved speechreading. On the time scale of all the vibrotactile aid training studies, which were relatively long (up to approximately one year), improvements in scores on sentences ranged between approximately 10 and 30 percentage points, with the largest gains observed in ***deaf*** participants who were in the aided conditions of the studies.

The Current Study

Given our previous study (Bernstein et al., 2000), we were particularly interested in whether short-term training/practice speechreading would demonstrate learning, and whether it would differentially affect ***deaf*** versus hearing speechreaders. Given the observations we and others made of gains in speechreading associated with training on a vibrotactile aid, two different training experiments were conducted. In Experiment I, a speechreading-only (SO) experiment, participants in training and testing speechread sentences without auditory or vibrotactile stimuli. In Experiment II, participants received vibrotactile speech stimuli during speechreading training (S+V), and only during training, and were tested via speechreading only. In each experiment, half the participants were ***deaf*** and half were hearing adults. The main questions investigated were (a) Is training/practice differentially effective across ***deaf*** versus hearing groups? (b) Does short-term training affect the relative standing of the individual speechreaders? (c) Does short-term training on sentence stimuli result in significant learning? (d) Does training with a vibrotactile speech aid enhance learning?

Method

Participants

College-educated adults with early-onset (before age 3) severe or profound hearing impairments and English as a first language were recruited for comparison with college-educated adults with normal hearing. The participants reported that they were good speechreaders, but they were not tested on their speechreading before the study.(n2)

Deaf Participants

Eight ***deaf*** participants, a different group of eight for each experiment, were screened to have the following characteristics: (a) be between 18 and 40 years old; (b) be a Gallaudet University student; (c) have better pure tone average threshold for 500, 1000, and 2000 Hz greater than 80 dB HL; (d) self-report no disability other than hearing impairment; (e) self-report use of spoken English as the primary language of the family; (f) self-report English (including signs presented with English syntax) as the participant's native language; (g) have been educated in a mainstream and/or oral program for 8 or more years; (h) self-report of good speechreading skills; and (i) vision at least **20/30** in each eye. Participants were paid by the hour.

Table 1 gives audiological information about the participants in each of the experiments and shows the number of years hearing aids were used and the age at which they were first used. The table also shows etiology of the hearing impairment. It was discovered after testing in the speechreading-only (SO) experiment that two of the participants had a better pure tone average threshold of slightly less than 80 dB HL. These participants were not replaced because the deviations (78 and 77 dB HL) from the 80 dB HL criterion were not deemed likely to have had a significant effect on the results. Age at onset for participants in the SO experiment was before 20 months. Seven of the participants received hearing aids by age 3, and one participant received a hearing aid at age 6. Only half were still using them at the time of the study. In the S+V experiment, 7 participants listed birth as the age at onset of hearing impairment. One participant listed age of onset as 30 months. Six participants received their hearing aids at age 3 or older, and 5 out of the 8 were still using their aid at the time of the study.

Participants With Normal Hearing

Eight participants with normal hearing were recruited from the Gallaudet University community for each experiment. They met the same requirements as the ***deaf*** participants, except for the requirement of normal hearing. Ages of participants in the SO experiment ranged between 23 and 39 years. Ages of participants in the S+V experiment ranged between 23 and 33 years. Participants were paid by the hour.

Materials

Table 2 lists the materials for training and testing in order of their presentation, including which of the lists were counterbalanced. Sentence stimuli (Bernstein & Eberhardt, 1986a, 1986b) were produced by a male and a female who spoke General American English. The B-E (Bernstein-Eberhardt) Sentences (male talker) and CID Everyday Sentences (Davis & Silverman, 1970) were sorted into lists with equal expected means based on previous results (Bernstein et al., 2000). The B-E Sentences (female talker) comprised four lists of 25 sentences, divided between pre- and posttest occasions. Two of the counterbalanced lists comprised sentences for which normative data were not available for computing expected means.

Training sentences were assigned randomly to lists, as there was not a previous database of responses upon which to calculate expected means. Participants never saw the same stimulus twice in the experiment. A 20-sentence practice list presented first to participants was constructed using sentences spoken by a third talker seen only during practice (Bernstein, 1991). Vocabulary in the CID Sentences and in the B-E Sentences consisted of high-frequency English words.

Vocabulary Test

The Peabody Picture Vocabulary Test-Revised (PPVT -R; Dunn & Dunn, 1981) was administered to all of the participants. Scores on the PPVT were obtained to investigate the possibility that vocabulary knowledge interacts with speechreading learning. The test is a four-alternative, forced-choice test of receptive vocabulary with a standardized method for selecting starting and stopping points in the list of age-normed test words. This test is normed for oral presentation of words. As we have done in other studies (e.g., Auer, Bernstein, & Tucker, 1998), we administered the test by presenting the words on printed cards. The results of presenting the test with this method were shown (Auer et a1., 1998) to be highly correlated with reading vocabulary test scores from the Stanford Achievement Test (SAT -8; The Psychological Corporation, 1989).

Vibrotactile Stimuli

The vibrotactile speech stimuli in the S+V experiment were presented via a vibrotactile vocoder, GULin, described in detail in Bernstein et a1., 1991. The vocoder presented the envelope of 16 consecutive filters to the underside of the lower forearm of participants via a set of 16 transducers corresponding to the 16 filters. The transducers were small solenoids that vibrated at 100 Hz. The vocoder spanned the center frequencies of 15 pass bands from 260 Hz to 3115 Hz, with the 16th filter being a 3565 Hz high pass filter. The GULin vocoder was shown by Bernstein et al. (1991) to be superior to two other vocoders tested and to provide significant speech information to enhance speechreading. Vibrotactile stimuli were presented only during training, not testing. All participants wore EAR earplugs and headphones through which pink noise was delivered to mask possible audible components of the vibrotactile stimuli.

Procedures

Table 2 shows the plan of training and testing. Each type of pre- versus posttest material was counterbalanced across participant groups within each experiment. Table 2 shows the counterbalanced lists. None of the training lists were counterbalanced, and none of the test lists for Sessions 2 through 5 were counterbalanced. By presenting lists in a fixed order in Sessions 2 through 5, it was possible to observe patterns attributable to list differences (as well as practice). By counterbalancing between pre- and posttest, it was possible to control for list effects in the analysis of pre- to posttest change in scores. It was not intended to analyze the training list scores, and therefore Training I versus Training 9 lists were not counterbalanced.

Participants sat in a darkened, sound-attenuating room. A personal computer was used to control stimuli and to record responses. A IS-in color monitor was placed on a small table in front of the participant, who viewed the screen at a 60-cm distance. Frontal images of the talker whose face filled the screen were presented. A computer key-press was used to initiate the first stimulus, and the return key was used after each subsequent stimulus and response. Participants were instructed to type exactly what they thought the talker had said. Partial responses and guesses were encouraged.

During training, the correct sentence was printed on the computer screen following each response. During testing, no feedback was given, and participants gave confidence ratings on each response. It was possible that confidence could change with performance or independently of performance. Participants were given the following instructions for giving confidence ratings: "Rate your confidence in the correctness of your response." Anchors for the rating scale were 0 = "No confidence--I guessed" and 7 = "Complete confidence--I understood every word." Numbers between 0 and 7 were used to represent intermediate degrees of subjective performance. As in Demorest and Bernstein (1997), the zero rating included the phrase "I guessed" so as to acknowledge that participants had been encouraged to respond and that they might therefore lower their criteria for responding (Van Tasell & Hawkins, 1981).

Before beginning the sequence of testing and training, participants were given practice performing the task with a 20-sentence practice list. Then pretesting was initiated. Training and testing alternated over 6 sessions, as indicated in Table 2. ***Deaf*** participants completed the protocol within 7 to 34 days, and hearing participants completed it within 7 to 21 days.

Sentence Scoring

Responses to all stimuli (in testing and training) were checked for spelling errors. Words correct were scored with a computer program that compared (in order) the stimulus words with the response words for each sentence. The words were counted as correct only if they were exactly correct, including contracted forms. Previous work in our laboratory has shown that scores do not change in a meaningful manner when scoring is less strict. Percent-words-correct was calculated across sentences for each stimulus list (in training and testing) for each participant.

It was possible that word-level scoring was insensitive to significant factors in the study that took place at the phoneme level. For example, participants could have become more accurate for certain phonemes, yet not have been able to achieve better accuracy for word identification. Therefore, responses were also scored at the phoneme level. To accomplish this, responses were first phonemically transcribed using software that looked up response words in the PhLex database of phonemically transcribed words (Seitz, Bernstein, Auer, & MacEachern, 1998). Then the transcribed response was submitted to a software sequence comparison program (Bernstein, Demorest, & Eberhardt, 1994) that aligned the stimulus and response, phoneme by phoneme. Sequence comparison (of which dynamic time warping is a specific case) takes into account differences in symbol strings attributable to substitutions, deletions, and insertions. The sequence comparator used here includes a minimization algorithm (Bernstein et aI., 1994; Sankoff & Kruskall, 1983) that seeks the lowest total cost for aligning the phonemes from the stimulus and response. The costs for phoneme-to-phoneme alignments were derived from phoneme confusion data obtained from experiments involving phoneme identification for speechread nonsense syllables (Bernstein et al., 1994). Phoneme-to-phoneme costs were Euclidean distances obtained via multidimensional scaling. Costs for insertions and deletions were selected so that perceptually implausible phoneme-to-phoneme alignments would not occur.

The following is an example of an alignment obtained with the sequence compartor:

Stimulus: p r u f rid y u r f a[sup j] n * (This character cannot be converted in ASCII text) 1 r I s DELTA 1 t s

Response: bluff – I Integral a – r f a n I - - - - - - - -

The stimulus was "proofread your final results," and the response was "blue fish are funny." The example has 5 correct phonemes (lu fr fn/), 6 phoneme substitutions (lp-b/, /r-1I, /i-IJ, /d-Integral/, /*y*-a/, /a[sup j]-Al, /x-IJ), 0 phoneme insertions ("_"), and 10 phoneme deletions ("_").

A measure of mean proportion phonemes-correct was obtained for each stimulus sentence list for each participant. Mean proportion phonemes-correct was the mean taken across all of the sentences scored individually in terms of total correct response phonemes weighted by the number of phonemes in the respective stimulus.

A measure of mean confidence was obtained for each stimulus list for each participant. This was simply the mean of all confidence ratings across sentences within each stimulus list.

Analyses

Within each experiment, omnibus analyses for each of the measures (percent words-correct, mean proportion phonemes-correct, and mean confidence) on each of the test sets (Cm Sentences, B-E Sentences with the male talker, and B-E Sentences with the female talker) were conducted. For cm Sentence Tests and the B-E Sentence Tests (male talker), 2 x 2 x 10 (Hearing Group x Experiment x Test) mixed analyses of variance were performed for each of the measures. The stimulus lists, analyzed in terms of their temporal order, are referred to as the factor test. Hearing group (hearing vs. ***deaf)*** was the between-subjects factor, and test was the within-subjects factor. A similar analysis was performed for the pre- versus posttest results of the B-E Sentence Tests (female talker). Analyses took into account counterbalancing between pre- and posttest sentence lists. That is, the data were analyzed in terms of the temporal order in which the participants received the stimulus lists, not in terms of list number. Linear trends were examined for the test factor and its interaction with group. Whenever group and/or test was shown to be a significant factor in the omnibus analysis, a reduced ANOV A was performed with pre- versus posttest as the repeated factor and group as the between factor. Because only the pre-and posttest scores were obtained with counterbalanced tests, this ANOVA was a more stringent method for evaluating learning than was the linear trend analysis, which included tests that were not counterbalanced.

Whenever percent words-correct scores were analyzed statistically, they were first submitted to arcsine transformations, which take into account the sampling variance of the score, and those results are reported here. However, whenever percent-correct means are reported, they are untransformed measures, to afford the reader direct access to the results.

Results and Discussion

Experiment I: Speechreading – Only (SO)

Within this section, percent words-correct scores are presented first, followed by mean proportion phoneme and confidence scores for each type of stimulus material. Table 3 is a summary of all of the means and ranges of test scores in terms of percent words-correct and mean proportion phonemes correct as a function of experiment.

CID Sentences, Percent Words Correct

In the omnibus ANOV A, when the CID Sentences were scored in terms of percent words correct, mean performance by the ***deaf*** group was not more accurate than that of the hearing group [F(I, 14) = 3.107, P = .100]. There was a significant effect of test [F(9, 126) = 7.330, P = .000], but the linear trend for test was not significant (p = .080). The reduced analysis for group and test concerned with assessing learning showed no significant effects.

Figure 1 shows the percent words correct means in the SO experiment in terms of group and test. The error bars represent +/-1 standard error of the respective mean.(n3) The significant main effect of test can be seen in Figure 1 as list-to-list variations across the two participant groups. Tests 2 through 9 were not counterbalanced or randomized, allowing the list-to-list pattern to be clearly evident. Between pre-and posttests, the effect of list-to-list variations was controlled via counterbalancing list order across participants, within groups. Therefore, list-to-list variation would not have been a factor in a reduced analysis, had it been required because of the results of the omnibus analysis. Demorest, Bernstein, and DeHaven (1996) showed with the same sentences and method of scoring that variance of test scores has several components. One of the largest is the error variance, followed by the subject, and the sentence. This suggests that variability is to be expected, even when an attempt has been made to equate across lists, and caution should be exercised in interpreting fluctuations as experimental effects (see Abelson, 1995, particularly Chapter 2). The apparently consistent nature of the list-to-list variation for Tests 2 to 9 (Lists B to I) suggests, however, that error was not the primary source of the variation--rather that the source was stimulus attributes that at this time have not been identified.

CID Sentences, Mean Proportion Phonemes Correct

In the omnibus analysis for CID Sentences scored in terms of phonemes, the ***deaf*** group was more accurate [F(l, 14) = 5.078, p = .041], and tests varied significantly [F(9, 126) = 9.117, p = .000]. However, test I group and the linear trends were not significant. The group difference remained in the reduced analysis [F(l, 14) = 6.414, p = .024], as did the effect of test [F(l, 14) = 11.984, p = .004]; however, their interaction was not significant. The learning effect was due to an increase in scores pre- to posHest of .097.

Figure 2 shows the proportion phonemes correct means for this experiment. The figure shows, as do the analyses, that groups were different and that overall scores showed a learning effect. Generally, scoring using phonemes correct resulted in higher scores than the corresponding percent correct words (see Table 3). This is straightforwardly explained by noting that partially correct words are counted as incorrect when word scoring is used but receive credit when phoneme scoring is used.

CID Sentences, Mean Confidence

In the omnibus analysis, mean confidence was the same across groups and varied across tests [F(9, 126) = 5.967, P = .000], including linearly [F(l, 14) = 5.734, P = .008]. In the reduced analysis, both test and the test x group interaction were significant [respectively, F(l, 14) = 26.947, P = .000 and F(l, 14) = 3.990, p = .000]. The interaction was investigated with t tests. ***Deaf*** participants did not vary in their confidence across pre- and posttest (p = .200), but hearing participants became more confident [t(7) = -6.804, p = .000].

B-E Sentence Tests, Male Talker, Percent Words Correct

None of the factors was significant when scores for these materials were based on percent words correct.

B-E Sentence Tests, Male Talker, Mean Proportion Phonemes Correct

When scores for these materials were based on mean proportion phonemes correct, only group was a significant factor in the omnibus analysis [F(l, 14) = 4.919, P = .044]. The reduced analysis for group and test resulted in no significant factors.

B-E Sentence Tests, Male Talker, Confidence

In the omnibus analysis, mean confidence was not different across groups (p = .219) but did vary across tests [F(9, 12.6) = 2.082, p = .036]. However, this test effect was not due to a linear trend. In the reduced analysis, the test' group interaction was significant [F(l, 14) = 11.430, p = .004]. The interaction was investigated with t tests. ***Deaf*** participants maintained their level of confidence across pre- versus posttests. But the hearing participants lost confidence [t(7) = 2.722, P = .030].

B-E Sentences, Female Talker, Percent Correct

By pre- and posttesting with a talker seen only on those two occasions, it was possible to investigate whether learning generalized. In the analysis of these sentence tests, within-subject factors were day (pre-vs. posttest) and test (first or second sentence set on each of the days). The between-subjects factor was group.

There was not a mean difference between groups (p=.174). However, both day and test were significant [respectively, F(l, 14) = 6.615, P = .022 and F(l, 14) = 5.785, P = .031]. The mean score was 21 % words correct on pretest and 23% words correct on posttest. On each day, the second test was more difficult than the first. Although the 2 percentage-point difference from pre- to posttest was reliable, its magnitude was extremely small, likely of marginal practical significance, and could be attributed to retesting with the same talker rather than carryover from training. Because no interaction took place between day and group, it can be concluded that there was not a differential effect of training/practice across groups.

B-E Sentences, Female Talker, Mean Proportion Phonemes Correct

Analysis failed to reveal any significant factors when sentences were scored in terms of phonemes.

B-E Sentences, Female Talker Confidence

Analysis failed to reveal any significant factors.

Summary Experiment I

In this experiment, group differences were not obtained when responses were scored in terms of words correct. Group differences were observed with the phoneme scores. The phoneme scores obtained with the CID Sentences resulted in a consistent advantage on the part of the ***deaf*** group for the omnibus and reduced analyses. The phoneme scores with the B-E Sentences (male talker) resulted in an advantage only in the omnibus analysis. No group effect was obtained with the B-E Sentences (female talker). A possible reason for the reduction in the group effect across materials was that the sets varied in difficulty. Table 3 shows that the CID Sentences were the easiest, followed by the B-E Sentences (male), and then the B-E Sentences (female). The magnitude of the difference between groups was compressed as the scores became lower.

The only evidence of learning in this experiment was with the cm and the B-E Sentence (female) Sentences when scored in terms of phonemes. None of the interactions between test and group was reliable for the performance measures (words or phonemes). That is, there was no evidence in the performance measures for a differential effect associated with group. However, confidence revealed a somewhat different picture. With the CID Sentences, ***deaf*** participants did not vary in their confidence, but hearing participants became more confident. The opposite pattern was observed with the B-E Sentences (male). In that case, hearing participants lost confidence.

The conclusion from this experiment was that training/practice did raise speechreading scores in deaf and hearing groups by small increments that did not favor either group.

Experiment II: Vibrotactile Speech Stimuli During Speech reading Training (S+V) CID Sentences, Percent Words Correct

In the omnibus analysis, when the CID Sentences were scored in terms of percent words correct, mean performance by the ***deaf*** group was more accurate than that of the hearing group [F(l, 14) = 12.203, P = .004] (see Figure 3). There was a significant effect of test [F(9, 126) = 2.552, P = .010], but the linear trend for test was not significant nor were any interactions. Group continued to be a significant factor in the reduced analysis [F(l, 14) = 12.300, p = .003], but test and test' group were not significant (ps > .474). Groups were reliably different, but there ~as not a reliable difference pre- to posttest.

CID Sentences, Mean Proportion Phonemes Correct

In the omnibus analysis, when the CID Sentences were scored in terms of phonemes, mean performance by the ***deaf*** group was more accurate than by the hearing group [F(l, 14) = 14.193, P = .002]. There was a significant effect of test [F(9, 126) = 4.320, P = .000], and the linear trend for test was significant [F(l, 14) = 28.433, P = .000], as was the test x group interaction [F(l, 14) = 5.499, p = .034]. In the reduced analysis, only the main effects of group and test were significant [respectively, F(l, 14) = 15.089, P = .002 and F(l, 14) = 5.639, P = .032]. However, the change in scores across pre- versus posttest was actually towards significantly lower scores (see Figure 4). Across groups, the decline was .086.

CID Sentences, Mean Confidence

In the omnibus analysis, mean confidence differed across groups [F(l, 14) = 6.225, p = .026] and across tests [F(9, 126) = 2.996, P = .003], but not linearly. In the reduced analysis, only the group effect was significant [F(l, 14) = 6.787, P = .021].

B-E Sentence Tests, Male Talker, Percent Words Correct

When the B-E Sentences were scored in terms of percent words correct, mean performance by the deaf group was more accurate than that of the hearing group [F(l, 14) = 12.867, p = .003]. There was a significant effect of test [F(9, 126) = 2.922, P = .004], and the linear trend for test was significant [F(1, 14) = 5.557, P = .033]. However, the group x test interaction was also significant [F(9, 126) = 1.975, P = .047], as was the linear trend for group x test [F(l, 14) = 9.062, P = .009]. However, only the group effect was significant in the reduced analysis [F(l, 14) = 10.507, P = .006]; therefore, there was no learning effect.

B-E Sentence Tests, Male Talker, Mean Proportion Phonemes Correct

Across tests, the groups were different [F(l, 14) = 11.819, P = .004]. Also the test and test x group effects were significant [respectively, F(9, 126) = 3.061, P = .002 and F(9, 126) = 2.361, P = .017], as was the linear test x group effect [F(1, 14) = 9.532, P = .008]. In the reduced analysis, only the difference between groups was significant [F(I, 14) = 10.814, P = .005]; therefore, there was no learning effect.

B-E Sentence Tests, Male Talker, Confidence

There were no significant effects.

B-E Sentences, Female Talker, Percent Correct

Across pre- and posttest, the groups were different [F(I, 14) = 7.204, P = .018]. On each day, the second test was more difficult than the first [F(I, 14) = 10.065, P = .007]. However, there was not a learning (i.e., day) effect. There were no interactions.

B-E Sentences, Female Talker, Mean Proportion Phonemes Correct

The results with phoneme scoring were similar to those with word scoring. Across pre- and posttest, the groups were different [F(l, 14) = 5.467, P = .035], and the test effect was significant [F(1, 14) = 12.984, P = .003]; however, the test x group effect was not. There was not a learning effect.

B-E Sentences, Female Talker, Confidence

There were no significant effects.

Summary Experiment II

In this experiment, groups were consistently different. Significant interactions of group x test in the omnibus analyses were due to list-to-list effects only, because the group x test interactions were not significant in the reduced analysis, which investigated the pre- versus posttest scores. There was not any indication of learning in this experiment. The only pre- to posttest change that was statistically reliable was in the direction of a decline in performance. The only significant effect associated with confidence was a group difference favoring the ***deaf*** group that was obtained with the cm Sentences.

PPVT Scores

The PPVT results were used to probe the differential learning effects across the two experiments. The PPVT standard score equivalent (SSE) for each of the participants was submitted to a univariate analysis of variance with group *(**deaf*** vs. hearing) and experiment (SO vs. S+V) as between-subject factors. Participants in Experiment II, S+V, had significantly higher PPVT scores than those in Experiment I**,** SO (mean 117 vs. 95, respectively) [F(I, 32) = 7.477, P = .011]. Hearing participants had significantly higher scores than ***deaf*** participants (114 vs. 97, respectively) [F(l, 32) = 4.834, P = .036]. The range of scores in the hearing group was 96 to 160. The range in the ***deaf*** group was 40 to 160. Group and experiment did not interact. Given the higher vocabulary knowledge of the participants in the S+V experiment, more learning might have been predicted in the S+V experiment; this did not occur. To probe whether PPVT scores were related to speechreading, the PPVT scores were submitted to Pearson correlation analyses with pre- and posttest scores from the CID and B-E (male talker) Sentences within each experiment. None of those correlations was significant. Thus, there was no evidence that learning was related to PPVT scores, either across experiments or within experiments.

CID Sentence Scores Across Experiments

Results of these experiments can be used to investigate whether short-term training/practice affects the relative standing of individual speechreaders. Although the two experiments differed in their training stimuli, in their evidence for learning, and in their overall scores on the PPVT vocabulary tests, they can be combined to investigate whether the relative standing of the individual participants was substantially affected by their participation in the study.

Figure 5 is a scatterplot of the CID Sentence pre- versus posttest percent correct words scores for each of the participants. Figure 6 shows the results in terms of mean proportion phonemes correct. The figures show that several hearing participants were the lowest scoring participants at pre- and posttest. Many participants, both ***deaf*** and hearing, performed in the midrange, as might be expected. The highest scoring participants at pre- and posttest were ***deaf*** No hearing participant exceeded the performance levels of the most proficient ***deaf*** participants (Participants SP03, TSD03, and TSD05; see Table 3). The highest three CID Sentence phoneme scores at posttest for ***deaf*** participants were .82, .89, and .97. The highest three phoneme scores for hearing participants were .60, .65, and .68. Participants SP03, TSD03, and TSD05 had severe to profound hearing impairments at birth. Bernstein et al. (2000) obtained similar examples of highly accurate speechreading from a different and larger sample of ***deaf*** speechreaders. The consistency of this observation supports the hypothesis that early severe to profound hearing impairment in some yet-to-be understood combination with reliance on visible speech can result in enhanced levels of speechreading accuracy.

Several hearing participants with scores in the vicinity of 25% words correct raised their scores to the vicinity of 60% words correct at posttest. But these large changes did not overcome the advantage of the most accurate ***deaf*** participants. Most important, overall participants did not change relative standing from pre- to posttest. This is demonstrated by the R square of .857 (R of .926) for the regression line through the total population of words correct scores in Figure 5, indicating high predictability from pre- to posttest performance levels. In Figure 6, the R square of the total population regression line when phoneme scores were used was even higher: .918 (R of .958).

General Discussion

Several conclusions can be drawn from this study. First, consistent evidence was obtained for a speechreading advantage among the ***deaf*** versus hearing participants in this study who were self-selected as good speechreaders. Second, whether or not learning occurred, it did not alter the relative standing of individual speechreaders. Finally, short-term training/practice on sentence stimuli was shown to result in a small but statistically reliable learning effect when training and testing were conducted in the same manner (SO), but not when the training was conducted with vibrotactile stimuli (S+V). Some additional comments about these results follow.

Group and Individual Effects

Training/practice was not found to be differentially effective across ***deaf*** versus hearing groups. No evidence for interactions between groups and tests was obtained for speechreading performance measures. Instead, a relatively consistent pattern of advantage for accuracy in the ***deaf*** groups was obtained. The current results do not encourage the conclusion that substantial group differences can be erased through a period of training/practice comparable in extent to that in the current study.

The relative standing of individual speechreaders was not affected by training/practice. Training did not bring any of the individual hearing participants up to the level of the most accurate ***deaf*** participants. Given the range of individual differences in the ***deaf*** and hearing populations (Bernstein et al., 2000), it is clear that groups with similar abilities can be recruited that are likely to remain similar across a period of laboratory testing. Groups that are recruited to be substantially different from each other are likely to maintain their differences across a period of laboratory testing.

Short-Term Training Effects

The results showed that short-term training can result in significant change, but its direction depends on the training conditions and perhaps also the test materials. The tests with CID Sentences (scored in terms of phonemes) showed that mean proportion phonemes correct increased .097 from pre- to posttest in the SO experiment, but decreased .086 in the S+V experiment. This pattern was not observed in the performance measures (phonemes and words) obtained with the B-E Sentences (male talker). However, the latter materials were more difficult (see Table 3), and the tests were possibly less sensitive given their brevity (see Demorest, Bernstein, & DeHaven, 1996). A significant improvement of approximately 2 percentage points was obtained in Experiment I with the B-E Sentences (female talker) tested at pre- versus posttest only. In Experiment II, there was not a pre- versus posttest improvement. This difference across experiments suggests that carryover might have influenced results with these materials.

Effect of Training With the Vibrotactile Speech Aid

We can only speculate at this time why the vibrotactile stimuli might have resulted in depressed scores. Perhaps previous enhancements to speechreading alone in experiments with vibrotacti1e stimuli were the result of more extensive training. Another possibility is that the S+V participants construed that their main task was to demonstrate that vibrotactile stimuli enhance speechreading and during testing unconsciously (or consciously) reduced their attention or effort to speechreading. A third possibility is that sensitivity to visual information actually declined as a result of relying on the vibrotactile stimuli (Sherrick, 1984). However, how the two modalities in Experiment II might have enhanced or interfered with each other during perception and in the total experimental context cannot be determined within the parameters of the current study.

Methodological Implications

A methodological issue relevant to this study is whether studies that compare ***deaf*** and hearing speechreaders should provide initial training in order to obtain stable performance that is not somehow favorable to one or the other group. Our results support the general finding in the literature that with repeated training/practice, speechreaders can show modest improvements. But our results do not support providing differential training/practice to hearing versus ***deaf*** speechreaders. The groups change modestly at the same rate.

Conclusions

These results suggest that speechreading differences between ***deaf*** and hearing populations are quite stable. Among ***deaf*** speechreaders there are individuals with enhanced speechreading capability whose superiority cannot be matched via short-term training by less accurate speechreaders from either the ***deaf*** or hearing population. The existence of stable individual differences sets the stage for future studies that can investigate the underlying sensory/perceptual and psycho linguistic processes responsible for the wide range of individual differences among speechreaders.

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(n1) In this paper, the term ***deaf*** refers to individuals with bilateral severe to profound hearing impairments. The term is not intended to connote those who consider themselves members of ***deaf*** culture. However, the extension of the term ***deaf*** to include individuals whose hearing impairment is severe is consistent with usage in the cultural deaf community.

(n2) The argument might be put forward that the appropriate design for this study would have been to use select participants randomly. In Bernstein et al. (2000), 96 hearing and 72 adults with impaired hearing were randomly selected in terms of speechreading ability, resulting in the performance advantage for ***deaf*** adults that motivated the current study. Therefore, statistically, the expected means for performance measures with random selection would be ones that favor ***deaf*** over hearing participants. By requiring self-report of good speechreading in both participant groups in the current study, the possibility was that no group difference would be obtained--a more conservative approach than random selection for the current investigation. An alternate design would have been to match groups on initial speechreading screening scores. Based on the expected values, matching would have likely required eliminating volunteers who were excellent ***deaf*** speechreaders--the actual focus of interest.

Another possible approach would have been to obtain a different sample of participants based on some other set of screening criteria. We chose the criteria of the current study based on previous results obtained in Bernstein, Demorest, and Tucker (1998), in which correlations were presented between speechreading measures (percent correct identification of nonsense syllables, words in isolation, and words in sentences) and audiological variables for the participants in Bernstein et al. (2000). In that study, the following variables did not correlate with speech perception measures: (a) age loss occurred, (b) age loss discovered, (c) medical or surgical treatment for loss (d) age first hearing aid obtained, (e) presently owns a hearing aid, (f) anacusic, and (g) better pure tone average. The variable years since last used hearing aid correlated with some measures, only at around .3. The variable frequency of hearing aid use correlated at approximately .35 with the various visual speech perception measures (but the sign changed across measures). These latter correlations, accounting for approximately 10% of the variance, should not be regarded as highly informative. Based on these results, it would be difficult to predict a priori the speechreading score of a particular ***deaf*** individual. The selection criteria, therefore, followed those of the Bernstein et al. (2000) study that motivated the current one.

(n3) The standard error of the mean is a measure of the sampling variance of the mean for samples taken from the same population (SPSS, 1998).

Table 1. *Deaf* participant information for SO and S+V experiments.

Legend for Chart:
A - 10
B - Age (years; months)
C - Age at onset (months)
D - Etiology
E – L Ear PTA dB HL
F – R Ear PTA dB HL
G - HA use now?
H - Age HA first used (months)
I - Length of HA use (years)

A	B	C	D
	E	F	G
	H	I	
		SO Experiment	
SP01	30;10	birth	unknown
	98	108	no
	30	11.5	
SP03	28;2	birth	unknown
	78	102	yes
	12	27	
SP04	21;4	birth	unknown
	110 (1 Freq)	110 (1 Freq)	no
	36	13	
SP05	23;3	20	unknown
	97	120 (1 Freq)	no
	20	5	
SP06	21;0	birth	unknown
	103	108	yes
	20	20	
SP07	24;0	birth	genetic
	77	83	yes
	24	22	
SP08	22;7	18	spinal meningitis
	107	120 (1 Freq)	no
	72	12	
SP10	22;6	6	maternal rubella
	85	88	yes
	24	20	
		S+V Experiment	
TSD01	27;1	birth	renal tubular acidosis
	100	85	no
	120	15	

TSD02	23;3 NMH(*) 36	30 NMH 11	spinal meningitis no
TSD03	18; 11 85 12	Birth 88 18	maternal rubella yes
TSD04	23;3 98 36	Birth 95 15	hereditary no
TSD05	27; 11 90 72	Birth 90 21	unknown yes
TSD06	25;6 102 16	Birth 85(1 Freq) 24	maternal rubella yes
TSD07	28;6 95 48	Birth 83 24	maternal rubella yes
TSD08	21;6 98 36	Birth 85 18	unknown yes

Note. NHM= no measurable hearing

Table 2. Number of sentences per training and testing session.

Legend for Chart:

A - Session
B - Materials type
C - B-E Sentences, female
D - CID Sentences, male
E - B-E Sentences, male

A	B	C D E
1	Pretest	50 (2 lists counterbalanced, pre- vs. posttest) 10 (List A) (Counterbalanced with List J, pre- vs. posttest) 5 (List A) (Counterbalanced with List J, pre- vs. posttest)
2	Training #1 Test #2 Training #2 Test #3	10 (List B) 10 (List C) 66(List 1) 5 (List B) 66 (List 2) 5 (List C)

3	Training #3 Test #4 Training #4 Test #5	10 (List D) 10 (List E) 66 (List 3) 5 (List D) 66 (List 4) 5 (List E)
4	Training #5 Test #6 Training #6 Test #7	10 (List F) 10 (List G) 66 (List 5) 5 (List F) 66 (List 6) 5 (List G)
5	Training #7 Test #8 Training #8 Test #9	10 (List H) 10 (List I) 66 (List 7) 5 (List H) 66 (List 8) 5 (List I)
6	Training #9 Posttest	50 (2 lists counterbalanced pre- vs. posttest) 10 (List J) 66 (List 9) 5 (List J)

Table 3. Means and ranges across materials, groups, and experiments.

Legend for Chart:

A - Group
B - Percent Words Correct Pretest Mean
C - Percent Words Correct Pretest Range
D - Percent Words Correct Posttest Mean
E - Percent Words Correct Posttest Range
F - Proportion Phonemes Correct Pretest Mean
G - Proportion Phonemes Correct Pretest Range
H - Proportion Phonemes Correct Posttest Mean
I - Proportion Phonemes Correct Posttest Range

A	B	C	D	E
	F	G	H	I
		CID Sentences, Test		
Exp. I				
Deaf	45	(27-69)	49	(30-94)
	.55	(.34-.73)	.61	
Hearing	28	(16-58)	35	(6-63)
Exp. II				
Deaf	64	(30-86)	60	(38-86)
	.68	(.49-.83)	.66	(.36-.89)
Hearing	33	(16-56)	40	(11-67)
	.51	(.27-.68)	.36	(.21-.60)
		B-E Sentences, Males Talker, Test		
Exp. I				
Deaf	44	(26-72)	49	(34-92)
	.53	(.43-.77)	.58	(.44-.96)
Hearing	36	(5-62)	35	(18-52)
	.44	(.08-.68)	.42	(.26-.57)
Exp. II				
Deaf	58	(52-69)	55	(34-97)
	.64	(.58-.71)	.59	(.31-.98)
Hearing	28	(5-48)	35	(11-74)
	.37	(.12-.55)	.45	(.16-.83)
		B-E Sentences, Female Talker, Test		
Exp. I				
Deaf	25	(17-45)	26	(10-55)
	.34	(.20-.57)	.36	(.16-.64)
Hearing	17	(10-22)	20	(10-31)
	.25	(.15-.32)	.28	(.17-.40)
Exp. II				
Deaf	31	(25-47)	32	(21-56)
	.40	(.22-.55)	.39	(.21-.63)
Hearing	19	(7-31)	22	(14-36)
	.26	(.18-.38)	.31	(.24-.44)

GRAPH: Figure 1. Percent words correct means for CID Sentences in the SO experiment in terms of group and test. The error bars represent +/-1 SE of the particular mean.

GRAPH: Figure 2. Proportion phonemes correct means for cm Sentences in the SO experiment in terms of group and test. The error bars represent +/-1 SE of the particular mean.

GRAPH: Figure 3. Percent words correct means for cm Sentences in the S+V experiment in terms of group and test. The error bars represent +/-1 SE of the particular mean.

GRAPH: Figure 4. Proportion phonemes correct means for CID Sentences in the S+V experiment in terms of group and test. The error bars represent +/-1 SE of the particular mean.

GRAPH: Figure 5. Scatterplot of the pre- versus posttest percent correct words scores (Cm Sentences) for each of the participants across experiments. The regression line was calculated through the origin for the entire sample population.

GRAPH: Figure 6. Scatterplot of the pre- versus posttest mean proportion phonemes correct scores (CID Sentences) for each of the participants across experiments. The regression line was calculated through the origin for the entire sample population.

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INTELLECTUAL ASSESSMENT OF DEAF AND HARD-OF-HEARING PEOPLE: A QUANTITATIVE AND QUALITATIVE RESEARCH SYNTHESIS

Abstract: A review of published and unpublished literature (N studies = 286; total N subjects> 171,517) describing the intelligence of ***deaf*** and hard-of-hearing people was conducted to determine: (a) assessment practices used with ***deaf*** and hard-of-hearing people, (b) outcomes of intellectual assessment with ***deaf*** and hard-of hearing people, and (c) the interaction between assessment practices and assessment outcomes. The results show (a) the research is growing at a slow pace and is often isolated from mainstream psychology, (b) the Wechsler Performance Scales are the most popular assessment instruments, (c) methods for administering tests are significantly and substantially related to measured intelligence, and (d) use of special norms does not affect IQs, and may be premature. Recommended practices, experimental methods, and quantitative outcomes consistently agree in pointing towards "best practices. for use with ***deaf*** and hard-of-hearing clients. Implications for practitioners serving deaf and hard-of-hearing people are also discussed

The intellectual assessment of ***deaf*** and hard-of-hearing people has interested psychologists and philosophers for many years. From the time of the ancient Greeks, the ability to speak has been considered synonymous with intelligence. For many centuries, the difficulty of ***deaf*** and hard-of-hearing people to acquire and use speech was considered tantamount to severe intellectual deficit, as reflected in the phrase "***deaf*** and dumb." However, Renee DesCartes, Diderot, and other post-Renaissance philosophers discriminated between one's use of speech and one's ability to reason. The discrimination of intellectual ability from acquisition and use of speech provided the foundation for differentiating deafness and hearing problems from mental retardation.

Educators and psychologists have attempted to differentially diagnose deafness and hearing problems from mental handicaps at least since the late 1800s (Greenberger, 1889). One of the first North American research efforts using the Stanford-Binet Intelligence Scales focused on its lack of appropriateness for use with ***deaf*** and hard-of-hearing people (Pintner & Paterson, 1915). Since the early 1900s, many investigations of the intelligence of ***deaf*** and hard-of-hearing people have been conducted. Unfortunately, much of the literature describing the intelligence of ***deaf*** and hard-of-hearing people has appeared in journals, newsletters, and limited-distribution publications oriented to deafness and hearing disorders and in other sources unknown to the typical school psychologist.

The purpose of this article is to summarize the literature addressing the intellectual assessment of ***deaf*** and hard-of-hearing people. This summary provides qualitative and quantitative descriptions, and hypothesis-testing outcomes. Specifically, the literature is described to acquaint practitioners with the diversity of psychological practices. This description is followed by qualitative and quantitative summaries of results. Hypotheses regarding the impact of study characteristics on IQ are tested to determine factors related to obtained IQs. These results are followed by a discussion of their scientific and practical implications, with an emphasis on best practices for accurately assessing the intelligence of ***deaf*** and hard of-hearing people.

METHOD

Bibliographic Sample

Computerized data bases comprising published (e.g., PsychLit, MedLine) and unpublished (e.g., ERIC, Dissertation Abstracts International) studies were searched for investigations of intelligence with ***deaf*** and hard-of-hearing people. Also, every issue of the American Annals of the ***Deaf***, the Journal of Speech and Hearing Disorders, and the Volta Review were searched to identify studies using intelligence tests with ***deaf*** and hard-of-hearing people. The reference lists from studies obtained in these searches were examined to identify additional studies. Additionally, letters were sent to prolific contributors to the recent literature, requesting reprints, unpublished works, or other relevant data. Active researchers were also called via telephone to solicit published, unpublished, or prepublished data This process was continued from 1987 to 1989 in order to identify works completed prior to the end of 1988.

The studies selected in this manner were included for further analysis if they met the following criteria: (a) use of an intelligence test intended to measure individual differences in intellectual performance with ***deaf***, hard-of-hearing, or hearing impaired people; (b) report of a mean IQ or qualitative classification (e.g., "Average"); (c) the study or its abstract was written in English. A total of 285 studies, which contained 234 independent samples of ***deaf*** and hard-of-hearing people, met these criteria. It should be noted that the criteria excluded studies using measures of academic achievement and Piagetian tests of cognitive development.

Studies meeting the criteria were retained regardless of quality, recency, or other attributes which could attenuate results. The issue of inclusion criteria in quantitative syntheses is unresolved (see Hunter, Schmidt, & Jackson, 1982). Poor as well as high quality studies were retained so that the impact of quality on IQs could be investigated. If studies which used "poor quality" procedures were excluded from the analyses, it would not be possible to test whether study quality was related to ***deaf*** and hard-of-hearing people's IQs. However, study characteristics were recorded in order to isolate the influence that test selection, test administration, and other study quality variables have on reported IQ (see Wolf, 1986, p. 15).

Variables and Analyses

Each study was described according to the following attributes:

1. year of dissemination;

2. size of sample (N);

3. whether the study was redundant with data reported in another study;

4. the name of the intelligence test used in the study,

5. whether the intelligence test was primarily verbal, motor-free nonverbal, performance, or unknown;

6. whether IQs were computed with reference to deviation from a normative sample, ratio IQ, deviation from an experimental sample, or whether the method was unreported;

7. whether normative IQs were derived in comparison to normative samples of deaf and hard-of-hearing people or normative samples of normal-hearing people;

8. whether the test was administered by gestural, oral, written, simultaneous speech and signs, Ray's method of signs (Ray, 1982); or unreported procedures, and

9. the mean IQ or qualitative description obtained by *deaf* and hard-of-hearing subjects in the study. [2]

Once the data for each study were coded, the impact of redundant v. independent data was examined. Although some experts argue that redundant data should be included in a synthesis to provide the broadest description and the strongest test of hypotheses, others argue that inclusion of redundant data may skew subsequent results. A compromise (Wolf, 1986) was adopted, in which the IQs of independent data were compared to IQs of redundant data. The comparison showed no effect for inclusion of redundant data ($t(283) = 1.71$, NS), and so all reports of IQ were included in subsequent analyses. Because many studies included multiple tests of intelligence, there were 62 qualitative reports of intelligence and 324 reports of mean IQ available for subsequent analyses.

The procedures used in this study are similar to those recommended for meta-analysis. However, the term quantitative synthesis is deliberately selected to describe the procedures used in this study. The distinction between meta-analysis and quantitative synthesis is drawn to highlight two important features: (a) this study does not summarize a series of control group v. experimental group comparisons, and (b) the units of analysis in this study, although converted to a common scale, retain the metric of M = 100 and SD = 15. Thus, the procedures employed in this study seek to identify the relationships between study attributes and obtained IQ across multiple studies, rather than provide a summary of experimental studies testing specific hypotheses. As such, the term "quantitative synthesis" is used to distinguish this summary from the customary control v. experimental meta-analysis, and the "effect size" metric (i.e., M = 0, so = 1) is avoided in favor of the familiar standard score metric (i.e., M = 100, SO = 15).

Each report from a study constituted a record, analogous to a subject, in the data base. Thus, statistical analyses were performed on the nine variables recorded for each study in a manner similar to analyses performed on attributes of subjects in a descriptive study. Qualitative data were counted, tabulated, and grouped together for presentation. Quantitative data were combined into descriptive statistics using weighted and unweighted methods. Weighted methods assign a greater or lesser "weight" to the study based on the number of subjects in the study, whereas unweighted methods weight each study equally regardless of sample size. ANOV As and t-tests were used to test hypotheses. Although the statistics are essentially the same as those that would be used in research where units of data were provided by subjects, it should be remembered that all analyses in this article were conducted on group outcomes such as means.

RESULTS

Descriptive

Bibliometric results. The year of dissemination for the studies in the data base ranged from 1900 to 1988, although 5 prepublication studies listed as "1988" appeared in print in 1989 or 1990. The median year of dissemination was 1972, meaning half of all studies were published after this date. There was a stable increase in the number of studies disseminated per year over the century ($r = .63$, $P < .0001$), although the cumulative rate of dissemination falls far behind cumulative publication for other exceptionalities such as learning disabilities (Braden, 1989). Thus, the study of intelligence in ***deaf*** and hard-of-hearing people is a growing field in terms of its absolute production of research projects, but the rate of growth is less than the rate of growth in related fields.

Sample sizes contained in the studies varied from 4 to 21,307, with a mean sample size of 275.35 and a median sample size of 54.00. A few large survey studies skew the mean sample size. The majority of samples comprised less than 65 subjects. Because a few studies did not report sample size, the cumulative N across all independent samples was at least 171,517. Most research was conducted in residential school settings on relatively small samples of ***deaf*** and hard-of-hearing children.

Clinical practices. The instruments used in the studies were counted across studies. Those tests used five or more times in the literature are presented in Table 1, along with the IQ reported for each instrument averaged across studies.

The results presented in Table 1 show a strong preference for use of the Wechsler Performance Scales for assessing ***deaf*** and hard-of-hearing people. These data are congruent with surveys of practitioners serving ***deaf*** and hard-of-hearing people in educational and clinical settings (e.g., Gibbins, 1989, Levine, 1974; McQuaid & Alovisetti, 1981; Spragins, Karchmer, & Schildroth, 1981; Trott, 1984), which show practitioners prefer the Wechsler Performance Scales over other tests for assessing the intelligence of ***deaf*** and hard-of-hearing clients. However, the small number of studies using the Leiter International Performance Scale is surprising, and the mean IQ it yields is lower than expected, in view of its popularity among survey respondents as a "favorite" for assessing ***deaf*** and hard-of-hearing clients.

The types of tests used in studies of deaf and hard-of-hearing people’s intelligence mirrored the performance shown for performance tests of intelligence. Of the 324 reports of mean IQ in the data base 204 used performance tests, 75 used motor-free nonverbal tests, 24 used verbal tests, and 21 were unclassifiable or unreported.

Administration practices varied in the literature. The most popular method for administering tests was signs accompanied with speech (N = 69), followed by oral administration (N = 36), gestural administration (N = 35), written administration (N = 5), and a special method developed by Ray (1982) for administration of the Wechsler Performance Scales to ***deaf*** and hard-of-hearing children (N = 4). However, more than half of the studies (N = 175) failed to describe test administration procedures.

The manner in which IQs are calculated varied among studies. The most popular method for deriving IQs was the deviation IQ method, in which a raw score is compared to the scores of a normative reference group of the same age (N = 214). The next most popular method was ratio IQs (N = 59), followed by deviations relative to an experimental sample (N= 32). A total of 19 studies were not classifiable with reference to the method for deriving IQ.

Norms based on ***deaf*** and hard-of-hearing people are available for at least 5 tests of intelligence: (a) the WISC-R Performance Scale (Anderson & Sisco 1977), (b) the Hiskey-Nebraska Test of Learning Aptitude (Hiskey, 1966), (c) the Snidjers-Oomen Nonverbal Tests (Zwiebel & Rand, 1978), (d) the Pintner Non-Language Test (Pintner, 1924), and (e) the Ravens Progressive Matrices (Raven, Court, & Raven, 1983). The Snidjers-Oomen was normed On Dutch and Israeli ***deaf*** and hard-of-hearing children, the Ravens Progressive Matrices was normed on West German ***deaf*** and hard-of-hearing children, and the other tests were normed on North American ***deaf*** and hard-of-hearing children. There have been other large-scale administrations of tests to ***deaf*** and hard-of-hearing children (e.g., ChatteIji MukeIjee, & Gupta, 1987; Du Toit, 1954), but these efforts have not been disseminated in a way that provides practitioners access to special norms. Special norms have been recommended for use with *deaf* and hard-of-hearing clients (e.g., Anderson & Sisco, 1977; Hiskey, 1966; Sullivan & Vernon, 1979), but this recommendation has yet to be supported with empirical data showing greater accuracy or better diagnoses of abnormality are achieved when special norms are used (Braden, 1985c, 1990). Of the studies in this quantitative synthesis, 30 used special norms, and the remaining 294 studies did not.

Syntheses of Intellectual Assessment

Qualitative. There were 52 qualitative descriptions of the intelligence of ***deaf*** and hard-of-hearing people in the literature. Qualitative descriptions were grouped into standard intelligence classifications, and are reported in Table 2. A perusal of the table suggests that qualitative descriptions of the intelligence of ***deaf*** and hard-of-hearing people usually falls into the average to low average range, with a marked positive skew in the distribution of outcomes. The qualitative results suggest the center of the distribution of intelligence in ***deaf*** and hard-of-hearing people is somewhat lower than the center of the IQ distribution in normal-hearing people.

Quantitative. The summary of 324 quantitative reports of mean IQ provides a higher estimate of ***deaf*** and hard-of-hearing people's intelligence than does the summary of qualitative reports. The grand unweighted average for all reports is 97.14 (where M = 100, and SD = 15), and the range of mean IQs varies from 56 to 122. Because the sample sizes vary among studies, an unbiased "effect size" (Hedges, 1982) was also calculated. This procedure minimizes the variation in outcomes related to sample size. The unbiased "effect size" of 97.20 is quite similar to the grand unweighted average. The grand unweighted average of reported SDs (based on 199 reports of SO) is 15.33. These quantitative estimates of IQs suggest that ***deaf*** and hard-of-hearing people have an IQ distribution quite similar to the distribution of IQ in normal-hearing people. These results concur with previous reviews of intellectual assessment in ***deaf*** and hard-of-hearing people (e.g., Vernon, 1967, 1968) suggesting that ***deaf*** and hard-of-hearing people exhibit average intelligence.

Relationships between Study Attributes and Reported Intelligence

The variables recorded for the studies may be related to the mean IQ reported for the study. In order to investigate this possibility, statistical analyses of IQs between studies were conducted on the 324 reports of mean IQ. These analyses investigate the relations between the mean IQ reported in the study and the year of dissemination, sample size, quality of the study, type of test, name of test, administration method, method for deriving IQ, and use of special norms.

Bibliometric relations. Correlations were used to determine whether year of dissemination and sample size related to the mean IQ reported in a study. The results show a modest positive relationship between year of dissemination and IQ ($r = .25$, $p < .0001$), but there is no relationship between sample size and IQ ($r = .01$, NS). The direction and magnitude of the correlation between year of dissemination and IQ suggest that older studies report lower mean IQs than do more recent studies. The lack of relation between sample size and IQ is congruent with the similarity of average v. unbiased estimates of IQ by showing sample size is not related to IQ. The plot of IQs on sample size yields an "inverted funnel," which is to be expected because small samples have larger standard errors of estimate than do large samples (Light & Pillemer, 1984).

Administration procedures and IQ. One concern common to all quantitative syntheses is the quality of studies included in the synthesis. Each of the studies in this synthesis was assigned a quality code based on test administration, IQ derivation, and type of test used in the study. Quality was rated in the following manner: (a) signed administration of test directions, a normative IQ method for deriving IQ, and nonverbal test use were assigned 1 point each; (b) gestural administration and sample-based IQ referents were awarded 0.5 points; and (c) written and oral administration, ratio IQ derivation, and verbal test type were assigned 0 points. The total quality index for a study consequently ranged from 0-3. The rank order assigned to study attributes was derived from recommended practices for testing ***deaf*** and hard-of-hearing people (Sullivan & Vernon, 1979).

A total of 149 studies reported procedures for all three study parameters. Most of these studies (55%) achieved a quality rating of 2.5 or higher, indicating that the majority of studies used high quality procedures. When studies with unknown or other characteristics were deleted from the analysis, study quality correlated with IQ ($r = .35$, $p < .0001$), meaning that poor study quality was associated with low IQ. Furthermore, year and study quality were related ($r = .56$, $P < .0001$). However, year of dissemination and IQ were not related when study quality was held constant (partial $r = .00$, NS). Separate analyses of administration factors, IQ referents, test type, and other study attributes were conducted to isolate the influence of administration practices on the IQs of ***deaf*** and hard-of-hearing people.

The mean IQs yielded by different types of tests differed significantly ($F(3,320) = 5.04$, $p < .01$). Performance tests ($M = 98.52$) and unknown/unclassified tests ($M = 98.43$) yielded higher mean IQs than motor-free nonverbal ($M = 95.02$) and verbal ($M = 90.89$) tests. These findings concur with experimental comparisons of verbal and nonverbal scales (e.g., Moores et al., 1987) and recommended practices with ***deaf*** and hard-of-hearing people (e.g., Sullivan Vernon, 1979) in showing tests with higher verbal content yield lower IQs than do tests with low verbal content.

In order to investigate the differences between reported mean IQs of particular tests, a subsample of studies was created. This subsample was selected so there were at least 5 studies per test, and unknown test types were excluded. Specific tests were nested within test type. Again, the mean IQs yielded by different types of tests differed significantly ($F(2,219) = 9.52$, $P < .0001$). Performance tests yielded a higher mean ($M= 99.23$) than motor-free nonverbal tests ($M= 93.92$, $F(1,219) = 8.98$, $p < .01$), and both types of nonverbal tests yielded higher IQs than verbal tests ($M = 84.36$, $F(1,219) = 8.64$, $P < .01$).

However, even when the influence of test type was held constant, tests varied significantly from each other (F(12,219) 3.83, p < .0001). This means that within a class of tests, not all tests yield comparable IQs. For Example, the mean IQ yielded by the Leiter International Performance Scale is lower than the means of any of the Wechsler Performance Scales, despite the fact that they are all performance tests. The means by test are reported in Table 1.

Reported IQs varied as a function of test administration method (F(5,318) = 2.61, P < .06). Ray's (1982) administration method yielded a higher mean IQ (M = 103.87) than signs and speech (M = 98.34), unknown or unclassified (M = 97.88), gestural (M = 96.04), speech only (M= 93.17), and written (M = 88.25) methods. Signed, gestured, and signed and gestured administration methods yielded higher IQs than spoken or written administration methods (Duncan's critical range p < .05). These findings concur with experimental studies (e.g., Sullivan, 1982) showing that signed administration methods yield higher IQs with ***deaf*** and hard-of-hearing people than do other methods. Also, Sullivan's results show pantomined administration yields lower results than signed methods. Her findings agree with other research (e.g., Graham & Shapiro 1953), and critiques of administration methods (e.g., Braden, 1985a; cf Hayes & Courtney, 1985). Experimental studies offer a more precise test of the influence of signed v. gestural administration than can be provided in the synthesis. The net effect of administration procedures appears to be that signed administration methods yield higher IQs than pantomined, oral, or written methods.

The manner used to derive IQs also results in differences in reported IQs (F(3,320) = 2.91, P < .05). Deviation IQs derived from normative samples (M = 98.33) are higher than IQs calculated using methods that are unknown/unclassified (M = 95.89), IQs based on experimental samples (M = 95.81), or IQs derived from ratios of Mental Age divided by Chronological Age (M = 93.93). Although there are no direct comparisons of methods used to derive IQs, the results suggest that the recommended practice of deriving IQs from representative norm samples yields higher IQs.

Finally, the use of special norms did not result in significantly different IQs (t(322) = 1.00, NS). The mean IQs derived using norms based on ***deaf*** and hard-of-hearing people (M = 99.02) are similar to the mean IQs derived from norms based on normal-hearing people (M = 96.95). Unfortunately, the comparison of IQs based on special norms to IQs based on other norms confounds test type, and specific tests which have norms for ***deaf*** and hard-of-hearing people. Therefore, a separate analysis of WISC-R Performance Scale data (N studies = 44) was conducted comparing WISC-R Performance IQ (PIQs) based on special norms to WISC-R PIQs based on normal-hearing norms. There was no difference (F(I,43) = 0.61, NS) between mean WISC-R PIQs based on special norms (N = 8, M = 98.77) and those based on norms from normal-hearing people (N = 36, M = 101.27). It appears that little difference in IQ exists when special norms are used (Braden, 1985c). However, the application of special norms can markedly change psychometric profiles within performance test batteries (Braden, 1990), and may affect clinical diagnoses based on psychometric profile analyses.

DISCUSSION

A number of issues raised by this investigation demand closer inspection. They relate to the understanding of why findings occur, and their implications for research and practice.

Understanding the Nature of the Findings

Limitations. It is imperative that the limits of the present study be acknowledged. Perhaps the most important is that only procedural factors were recorded and related to reported IQ. This means that the influence of subject characteristics (e.g., age, degree of hearing loss, site from which subjects were sampled) was not measured within this study. To the degree that certain kinds of subject traits are associated with specific practices, the results may be skewed. For example, the difference between Leiter and WISC-R Performance IQs may be due to the practice of administering the Leiter to low-functioning ***deaf*** and hard-of-hearing children, and administering the WISC-R to high-functioning ***deaf*** and hard-of-hearing children, rather than an inherent difference between the tests.

A second concern is the potential confounds among study characteristics and reported IQs. Some of these confounds are inherent in the test (i.e., there is no verbal version of the Ravens Progressive Matrices), but others are not (e.', there are no studies of the Hiskey-Nebraska using oral directions, Ray's administration procedure, norms based on normal-hearing children, or sample IQs). Due to the tendency for studies to use procedures in related ways, the results linking a study characteristic to IQ are not "pure" estimates of the study characteristic. Rather, results should be considered estimates or trends based on an admittedly flawed research foundation.

Relative to special norms, it was possible to complete a nested design in which test type, specific test, method of administration and procedure for deriving IQ were held constant (i.e., the only variable was special v. regular norms). Similar nested comparisons were simply not possible for other variables in the literature review, because there were not enough studies to permit such comparisons (e.g., a comparison of special v. regular norms using the Hiskey-Nebraska was not conducted because there are no reports of Hiskey-Nebraska IQs using regular norms with ***deaf*** and hard-of-hearing subjects).

Bibliometric findings. The correlation between the year in which a study is published and the mean IQ reported in the study suggests two alternatives. One is that ***deaf*** and hard-of-hearing people are "catching up" with normal-hearing peers in the development of intelligence. ***Deaf*** and hard-of-hearing people may benefit from gains in early diagnosis, or acceptance of manual communication, which could lead to "closing the gap" between them and normal-hearing peers with respect to intelligence. A more likely alternative is suggested by the correlations among study quality, year of dissemination, and IQ. Earlier studies tended to be of poor quality. The fact that year of dissemination did not relate to IQ when study quality was held constant implies that the correlation between year of publication and IQ is primarily a function of the inadequate procedures used in early research. Methodological factors may also account for the apparent discrepancy between qualitative and quantitative estimates of intelligence among ***deaf*** and hard-of-hearing people. Qualitative studies are typically of poor quality relative to quantitative studies.

The synthesis also describes the relative lethargy of research regarding the intelligence of ***deaf*** and hard-of-hearing people. The modest increase in number of studies per year suggests the research regarding intelligence in ***deaf*** and hard-of-hearing people is growing. However, the rate of growth is relatively slow. Also, most studies are quasi experimental, pseudo-experimental, or descriptive in nature (e.g., correlational studies on samples of children in residential schools), rather than deliberate investigations of hypotheses or problems. Although some exceptions exist, the "research" is largely composed of archival data summarizing IQs of *deaf* and hard-of-hearing people.

In much the same way ***deaf*** and hard-of-hearing people are isolated from the mainstream of society, research in this area is isolated from the mainstream of psychology. Most of the literature in this synthesis was obtained from sources close to the ***deaf*** community, such as journals and newsletters devoted to deafness and hearing disorders. Little information makes its way into mainstream psychology journals. This may be due to the poor quality of the research, but it also could be due to resistance among psychological journals to allocate space to "low incidence" topics such as deafness and hearing disorders. The net effects of this journalistic isolation are that psychologists who do not read journals related to deafness and hearing disorders are unlikely to be familiar with the research, and the field of deafness is unlikely to attract high-quality psychological researchers because of the low visibility of research about deafness and hearing disorders.

Study characteristics and their relationship to IQ. The results suggest that, to the degree researchers follow recommended practices for using nonverbal tests, signed administration, and deviation IQs based on normative samples, they are likely to find that ***deaf*** and hard-of-hearing people have IQs closer to the mean for normal-hearing people. It must be recognized that approximating the mean for normal-hearing people does not imply a method is better or worse than a method leading to deviations from the normal-hearing range. For example, a test of height which reduced differences in height distribution between men and women would be less, not more, accurate. The premise "If it yields IQs closer to normal-hearing people, it's better" is an example of the "egalitarian fallacy" (Jensen, 1980). Despite its fallacious nature, many authors routinely assume that methods producing higher IQs are better than methods yielding lower IQs.

There are, however, reasons independent of IQ outcomes for recommending nonverbal tests, signed administration, and use of deviation IQs. Because ***deaf*** and hard-of-hearing people do not have access to verbal content, verbally-loaded tests should not be used to estimate intelligence. The situation is analogous to the use of English-language tests with non-English speaking populations; because the test becomes to some unknown degree a test of English proficiency, it confounds language achievement with intelligence. The question of whether verbal tests over-or under-estimate crystallized intellectual abilities has not been adequately addressed. Although verbal tests yield lower IQs for ***deaf*** and hard-of-hearing people than nonverbal tests, research on verbal reasoning tasks with ***deaf*** and hard-of-hearing people (e.g., Moores, 1970) suggests that standardized tests overestimate the verbal reasoning abilities of ***deaf*** and hard-of-hearing people. In other words, the average discrepancy between ***deaf*** and hard-of-hearing people's verbal reasoning ability and their nonverbal reasoning ability could be greater than the 1 SD difference suggested by this quantitative synthesis.

Signed administration can be defended on the basis of task comprehension, independent of effects it may have on obtained IQs. ***Deaf*** and hard-of-hearing people in North America, and increasingly in other parts of the world, are being educated with simultaneous presentation of signs and speech. Thus, use of signs is needed in order to render the directions into the client's native language, and thus enhance task comprehension. Deviation IQs based on large, representative samples are technically superior to other methods for deriving IQ. Consequently, procedures using nonverbal tests, signed administration, and deviation IQs are recommended for use with ***deaf*** and hard-of-hearing people independent of their effects on mean IQ.

The question remains whether special norms should be preferred over regular norms when assessing ***deaf*** and hard-of-hearing people. The arguments in favor of special norms rest primarily on the assumption that it is preferable to compare an individual to other members of the same group, rather than members of a different group. This reasoning smacks of the standardization fallacy (Jensen, 1980), which erroneously assumes tests normed on one group will inevitably be less accurate, or systematically underestimate, the abilities of individuals from another group. Often, it is preferable to compare individuals to an arbitrary, fixed referent group, so that trends over time can be noted. For example, the Scholastic Aptitude Test yields scores extrapolated with reference to the normative sample who took the test in the late 1940s. Despite the lack of logic, and the value of fixed referent groups, many psychologists still cling to the belief that it is always better to compare individuals only to norms based on members of their own group.

The arguments against special norms rest primarily on technical and empirical grounds. Special norms are rarely based on large, representative samples using rigorous, standardized administration procedures. For example, Anderson and Sisco's (1977) norms are based on a large sample of ***deaf*** and hard-of-hearing people, but there was no attempt to adhere to a standardized administration procedure.[l] Empirically, there is no evidence that special norms result in more accurate diagnoses of general intelligence, or more accurate diagnosis of clinical abnormalities (Braden, 1985c). Overall estimates of intelligence are unaffected by special norms, but diagnostic indicators in psychometric profiles are markedly attenuated by special norms (Braden, 1990). Special norms may cause more problems than they solve, although investigation of this issue is needed to resolve arguments regarding special norms.

The results of this synthesis also raise the question of whether motor-free nonverbal tests are interchangeable with performance tests for assessing ***deaf*** and hard-of-hearing people's intelligence. The lower mean IQs for motor-free tests may be due to reduced task comprehension or the reduced ability of ***deaf*** and hard-of-hearing children to fluidly and effectively coordinate reasoning skills using an internal language system (Conrad, 1979). Conversely, somewhat higher performance IQ means could be due to ***deaf*** and hard-of-hearing people's relatively better-developed motor speed for manual dexterity tasks (Braden 1987). Also, the results of the nested analyses of variance show that not all tests within a given test type are equal. For example, the Wechsler Performance Scales generally yield higher Performance IQs than the Leiter. Because of the dearth of studies comparing multiple intelligence tests within the same sample, it is not known whether the differences among tests are a function of sample selection, test characteristics (e.g., subtest complexity, norms), or administrative procedures.

Practical Implications

The results of this synthesis may help school psychologists serve ***deaf*** and hard-of-hearing clients better with respect to selecting, administering, and interpreting intelligence tests. Selection, administration, and interpretation issues shall be discussed with respect to how the results can, or cannot, assist practitioners in making informed decisions in the best interests of serving ***deaf*** and hard-of-hearing clients.

Before selecting a test of intelligence, psychologists should clarify the purpose of test administration. In many cases, they will want to administer a test to differentially diagnose intellectual deficits from the language delays and other concomitants of deafness and hearing disorders. The results suggest that nonverbal tests are best for such differential diagnosis, because verbal tests yield substantially lower IQs than nonverbal tests. Given the potential for misinterpretation of verbal IQs, verbal tests of intelligence should not be used with ***deaf*** and hard-of-hearing people (Sullivan & Vernon, 1979).

However, various types of nonverbal tests may yield inconsistent results. On one hand, performance tests of intelligence (e.g., Wechsler Performance Scales) may be preferable to motor-free nonverbal tests (e.g., Ravens Progressive Matrices), because the task demands may be easier to communicate, and the ability to achieve a solution may be less dependent on internal language. On the other hand, performance tests are inappropriate for children suspected of having fine motor disabilities. ***Deaf*** and hard-of-hearing people who have cerebral palsy or other motor deficits should be given untimed, motor-free nonverbal tests in order not to confound motor skills with intellective abilities. Psychologists may consult the data provided in Table 1 to identify the frequency with which the test has been used in previous research, and the average outcome reported for ***deaf*** and hard-of-hearing people on the test.

Practitioners should not necessarily select tests which have special norms. The results show that special norms have no consistent effect on IQ, and other research suggests that psychometric profiles are attenuated by the application of special norms (Braden, 1990). Because the research linking clinical and organic abnormalities to ***deaf*** and hard-of-hearing children's psychometric profiles is based on regular norms, practitioners who attempt to interpret psychometric profiles based on special norms do so without any empirical support (Braden, 1985a, 1990).

When psychologists administer tests to a ***deaf*** or hard-of-hearing child, they should take steps to insure the child understands task demands. The results suggest the best method for insuring task comprehension is for psychologists serving ***deaf*** and hard-of-hearing children to become fluent in language systems used by ***deaf*** people, and to use the subject's native language when administering tests. Psychologists should not rely on oral, written, or gestural directions to ***deaf*** and hard-of-hearing children. Unfortunately, there are two critical issues which have not been addressed in the literature. The first is whether variations in sign systems, such as American Sign Language, Signing Essential English, or Pidgin Sign English, affect the outcomes of intelligence tests with ***deaf*** and hard-of-hearing people. To date, the research is limited to directions given via oral/written v. gestures v. simultaneous presentation of speech and signs, with no systematic attempts to investigate the effects of different sign systems. The second limitation of the research is that there are no data regarding the effects of sign language interpreters on IQs. Despite the fact that many psychologists may rely on interpreters to assist them in test administration, none of the studies in this synthesis specifically investigated this issue. Thus, psychologists who administer tests to ***deaf*** and hard-of-hearing children with an interpreter do so without knowing what, if any, effects the interpreter may have on the ***deaf*** or hard-of-hearing child's test scores. Psychologists who do not have communication skills for serving ***deaf*** people should develop arrangements with other psychologists, districts, or regional centers serving ***deaf*** and hard-of-hearing children in order to obtain the services of a psychologist with appropriate skills and experience for assessing ***deaf*** and hard-of-hearing children.

A psychologist must interpret obtained IQs as a function of two variables: (a) the degree to which the psychologist can feel confident that the test administration was effective and efficient, and (b) the construct and normative group to which the psychologist wishes to compare the results. If the psychologist has selected an appropriate test and given the test in an appropriate manner, the psychologist is ready to draw inferences about the ***deaf*** or hard-of-hearing child's intelligence on the basis of the test results. The structure of nonverbal intelligence is similar for ***deaf*** and hard-of-hearing children and hearing children (Braden, 1985b; Braden & Zwiebel, 1991; cf Zwiebel & Mertens, 1985).Given the constancy of factor structures, and the similarity of IQ distributions shown by this synthesis, practitioners may interpret nonverbal intelligence test results for ***deaf*** and hard-of-hearing people in much the same way in which they interpret results for normal-hearing people. Two caveats must be kept in mind. The first is that the test(s) must be appropriately selected and administered. The second is that psychometric profiles derived from special norms have not been sufficiently investigated to warrant clinical interpretations.

Conclusions

The results of this investigation show strong concordance with surveys of practitioners, experimental studies, and recommended practices for serving ***deaf*** and hard-of-hearing people. Such harmonious results are not always achieved in syntheses of the literature. The synthesis suggests there is a substantial literature describing the use of intelligence tests with ***deaf*** and hard-of-hearing people, but the literature is not widely disseminated to school psychologists. The literature shows that nonverbal tests yield substantially higher IQs than do verbal tests for ***deaf*** and hard-of-hearing people, and that poor administration practices, such as presentation of directions using speech or writing or use of ratio IQs are associated with lower IQs. There are two findings in this synthesis at odds with recommended practices. The first is the use of special norms based on ***deaf*** and hard-of-hearing people, which have yet to be supported with empirical research. The second point of dispute is the failure of the previous literature to distinguish between motor-free nonverbal and performance tests of intelligence. Each of these topics could be addressed readily with a straightforward experimental study; however, true hypothesis-testing studies are rare in this literature. It is hoped that, by highlighting practical and research issues related to the study of intelligence in ***deaf*** and hard-of-hearing people, more school psychologists (a) will develop and adhere to appropriate practices when assessing ***deaf*** and hard-of-hearing; people, and (b) will be attracted to conduct research on the intelligence of ***deaf*** and hard-of-hearing people.

FOOTNOTES

[1] The term "***deaf*** and hard-of-hearing" is used instead of the term "hearing impaired" throughout this article because of the preference for persons with hearing impairments to refer to themselves as "***deaf***'or "hard-hearing." In Addition, School Psychology Review has a policy for the use of "person first language" in articles. However, this article uses "***deaf*** and hard-of-hearing people" because ***deaf*** and hard-of-hearing people prefer this use instead of “people who are ***deaf*** and hard-of-hearing.”

[2] Deviation IQs on a scale other than M = 100, SD = 15 were converted to this metric in order to eliminate the effects of scale among studies. For example, a British Ability Scale IQ of 56, with a M = 50 and SD = 10, would be converted to an IQ = 109.

[3] It has come to my attention that two other articles purportedly based on the special norms data (Sisco, 1982; Sisco & Anderson, 1980) report means that do not agree with 1977 normative data. In my attempts to reconcile this discrepancy, I have discovered that the original data have been lost. Although Sisco, Anderson, and the special norms publisher (Gallaudet University Office of Demographic Studies) are reasonably certain the 1977 norms are accurate, they cannot be verified, nor is the discrepancy between 1977 and later results resolved.

Table 1
Intelligence Tests Used to Assess ***Deaf*** and
Hard-of-Hearing People

Name of Test	N Studies	Mean IQ
Performance Tests		
Chicago Non-Verbal Examination	5	97.5
Grace-Arthur Performance Scale	16	96.02
Hiskey-Nebraska Test of Learning Aptitude	17	97.53
Kaufman-Assessment Battery for Children	6	96.86
Leiter International Performance Scale	12	87.19
Ontario School Ability Examination	6	98.44
Snidjers-Oomen Nonverbal Tests	5	96.71
WAIS-R Performance Scale	9	102.84
Wechsler-Bellevue Performance Scale	11	107.32
WISC Performance Scale	38	101.22
WISC-R Performance Scale	44	100.81
Motor-Free Nonverbal Tests		
Draw a Man/Person	13	91.72
Pintner Non-Language Test	13	91.84
Ravens Progressive Matrices	17	97.56
Verbal Tests		
WAIS-R Verbal Scale	5	84.36

Table 2

Qualitative Reports of ***Deaf*** and Hard-of-Hearing People's Intelligence

Category (IQ interval)	N Studies	Sample of Qualitative Descriptions
Borderline (65-79)	5	3 year delay; EMR/Borderline
Low Average (80-89)	15	2-3 year delay; 2 year delay; Low Average; Lower; Delayed; Lag in Development
Average (90-109)	24	Average; About 95; Average to low average; Normal; All IQs greater than 90.

Above Average (110-119)	3	Above Average; High Average
Superior (120 and above)	1	Superior.
Unclassified	4	10-12% Mentally Retarded; Fifth grade; Ninth grade; Not pathological

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THE SCHOOL-TO-COMMUNITY TRANSITION EXPERIENCES OF HEARING YOUNG ADULTS AND YOUNG ADULTS WHO ARE DEAF

This study examined the school-to-community transition experiences of hearing young adults and young adults who are deaf. Independent variables included hearing status, gender, and, for the deaf group, residential and main-stream school placement. Dependent variables addressed employment, independent living, and social experiences. Overall, the hearing persons exhibited more success than the deaf persons from either mainstream or residential schools. Gender differences did not uniformly favor men, as women outperformed men on selected variables. Suggestions for improving transition programs for persons who are deaf are provided.

The school-to-community transition experiences of adolescents and young adults with disabilities have assumed a high profile in special education and rehabilitation in recent years (Clark & Knowlton, 1987; Halpern, 1990; Rusch, DeStefano, Chadsey-Rusch, Phelps, & Szymanski, 1991; Will, 1984). Review of this literature indicates that varying groups will exhibit different transition experiences (DeStefano & Wagner, 1991); one population for whom there are few transition data is individuals who are deaf (Bowe, 1988; Bullis, Bull, Sendelbaugh, & Freeburg, 1987; Bullis, Freeburg, Bull, & Sendelbaugh, 1990).

Perhaps the best-known effort to describe the transition experiences of persons with disabilities is the National Longitudinal Transition Study (NLTS), conducted by SRI International (Valdes, Williamson, & Wagner, 1990). This study was commissioned by the U.S. Congress to provide a profile of the transition experiences (i.e., school completion, employment, postsecondary education, independent living, social) of persons with disabilities who leave public education and enter society. This study included a nationally representative sample of 246 deaf persons who were 3 to 5 years out of high school. The following results represent only a few of the findings: (a) sixty percent of the sample were enrolled in or had pursued some type of postsecondary education, and 22% were currently or had been enrolled in a 4-year college (Marder, 1992); (b) 43.5% of the entire sample of deaf participants were competitively employed, including 55% of the males and 29% of the females (D'Amico & Blackorby, 1992); (c) 85% had been employed at some time since leaving high school (D'Amico & Blackorby, 1992); and (d) 60% of all persons with disabilities reported finding their jobs by themselves, and 84% found their job through the self/family/friend network (these data were not broken down by disability group; D'Amico & Blackorby, 1992). This project, and others that have sought to describe the transition experiences of persons who are deaf (e.g., Allen, Rawlings, & Schlidroth, 1989; El-Khiami, 1989), is important in profiling the achievements and needs of this population. Three procedural issues should be attended to in this type of research to yield meaningful and accurate results.

First, generally, parents of deaf people are relied on as the primary data source on the transition of their deaf children. Our recent article (Bullis, Bull, Johnson, & Peters, 1994) examined the agreement between pairs of parents of deaf persons and their own sons or daughters and found reasonably strong kappa (Cohen, 1960), and other agreement indices (Cicchetti & Feinstein, 1990; Feinstein & Cicchetti, 1990), between the two sets of responses to specific questions in a transition study. This agreement was not perfect, however. From an ethical standpoint, we believe it is inappropriate to rely on parent input in studies of this type, as people who are deaf should be centrally involved in data-gathering efforts involving them and their lives (Lane, 1988). Of course, such inclusion demands that data-collection procedures be tailored to the communication characteristics of people who are deaf, emphasizing individual interviews administered by persons skilled in sign communication (Bullis et al., 1994).

Second, most studies describe the transition experiences only of persons who are deaf (Bullis et al., 1987, Bullis, Freeburg, et al. 1990). Such an approach falls short of presenting a clear picture of their successes and problems, as understanding cannot be reached without comparison to some standard, preferably the experiences of nondisabled (in this case, hearing) peers (Edgar, 1985; Fairweather, 1984). To address this problem, some research efforts contrast the transition experiences of persons with disabilities with data on peers without disabilities from extant data bases. However, further problems arise, in that these studies may have used different sampling frames and their data may not provide a direct and valid comparison standard (e.g., Marder & D'Amico, 1992).

Third, too often people who are deaf are treated as a homogeneous group, when in reality the population varies dramatically. Most research in deafness and transition has been conducted with persons who pursue postsecondary education--individuals who would be considered successful in terms of achievement and abilities (Bullis et al., 1987). Students from residential schools generally exhibit lower academic performance and present a higher percentage of secondary disabilities than do peers from mainstream settings (Karchmer, 1985; Schlidroth, 1988). Evidence suggests that gender may play an important role in the transition experiences of this group, as deaf women tend to achieve at levels below those of deaf and hearing men, as well as of hearing women (Barnett, 1982; Egelston-Dodd, 1977; Schroedel, 1987). The results of recent transition studies, however, do not provide definitive results on the effect of gender on the community adjustment experiences of adolescents with disabilities (Blackorby & Edgar, 1992; DeStefano & Wagner, 1991).

The purpose of the present study was to compare the transition experiences of all deaf persons who had left mainstream or residential education settings with the transition experiences of hearing peers from the same locales, while addressing each of the methodological considerations mentioned above. We addressed the question, "How do young deaf adults from mainstream and residential education programs compare to hearing peers in terms of their transition experiences after leaving high school?" We have elected not to emphasize the differences in transition achievement between deaf-mainstream and deaf-residential groups. As mentioned above, students who attend mainstream schools are qualitatively different from those who attend residential schools, so comparisons between these two groups are complicated and may not be valid because of those inherent differences (Bullis, Freeburg, et al., 1990).

METHOD

Data used in this article were gathered in an investigation of the school-to-community transition experiences of adolescents and young adults in the Pacific Northwest who are deaf (Bullis, Bull, B. Johnson, P. Johnson, & Kittrell, 1990). Deaf and hearing participants in this study were 3 to 4 years out of high school when interviewed; they were interviewed once at that time regarding their high school and post-high school community experiences. This type of research approach is termed a retrospective or follow-up investigation (Halpern, 1990).

Sites and Subjects

A total of 20 school programs in Oregon, Washington, and Idaho, representing mainstream schools (metropolitan, urban, and rural settings) and residential schools, participated in the study. Thirteen programs served deaf subjects and seven served as comparison sites, supplying the hearing subjects. Programs were selected because of geographical convenience, being representative of the type of educational settings in which persons who are deaf are educated, and willingness to participate.

A contact person (usually a secretary) at each site was hired to compile lists of deaf individuals who received special education services because of their hearing loss and who left the school (graduated, dropped out, or aged out), in the years designated for investigation. The first project year (1987) included persons who left school in 1983 or 1984, the second year (1988) included persons who left school in 1984 or 1985, and the third year (1989) included persons who left school in 1985 or 1986.

Comparison groups of hearing persons who had not received special education services for any reason were constructed for each year being investigated, to establish a standard against which to compare the transition experiences of the deaf participants. We asked administrators of programs involved in the study to nominate a particular school or school district in their region that could supply hearing students. These sites were contacted, and, if permission was secured, lists of hearing participants were compiled in one of two ways: (a) They were selected randomly from district-wide class lists, or (b) a convenience sample was established by identifying a particular high school and selecting specific individuals or classes.

Data-Collection Protocols

We constructed questionnaires containing questions in six major areas: vocational/work experience, independent living, social/personal experiences, secondary and postsecondary education background, involvement with community agencies, and personal and family characteristics. Project staff extensively reviewed preliminary drafts of the interviews. Two separate pilot tests of the protocol were conducted, each with three to five hearing persons and three to five deaf persons, which led to revision and clarification of the questions and response options. The final protocols for the hearing respondents took 20 to 30 minutes to complete via a phone interview. Protocols for the persons who are deaf were administered individually by an interviewer skilled in manual communication and took 30 to 60 minutes to complete.

Data-Collection Procedures

Data collection began in the spring of each of the 3 project years and ended in the early summer. Most sites we worked with required that we first contact a parent of the hearing or deaf person to secure permission to interview their son or daughter. After securing permission, we interviewed the student. Each student participant who completed an interview was paid $5.

Two methods of administering the interviews were employed. Hearing participants were questioned by interviewers utilizing a Computer-Assisted Telephone Interviewing approach. With this data-collection technique, the interviewer read the interview questions from a computer screen to the subject, and, as responses were given, they were immediately coded on the keyboard and stored in a central data bank. Before being allowed to engage in actual interviews, phone interviewers received 25 hours of training in the administration process and reached agreement levels of at least 95% with predeveloped protocols and field tests. At least three agreement checks were made periodically on each interviewer over the course of the data-collection period. In this process, one interviewer interviewed a subject while another interviewer, not participating in the exchange, also coded the responses on an equivalent written form. Interjudge agreement/disagreement was calculated for each question and averaged for the entire protocol (Goodwin, Sands, & Kozleski, 1991). A minimum of 95% agreement was maintained over the course of data collection. Interviewers who did not maintain this level were retrained or replaced.

The second data-collection method used the same protocol as above, but accommodation was made for the unique communication characteristics of persons who are deaf through an individually administered signed interview. To recruit interviewers skilled in sign language, administrators of school programs with whom we worked were contacted and asked to recommend candidates for these positions. These interviewers were skilled in a variety of manual communication modes (e.g., American Sign Language, Pidgin Sign English) and were screened by project staff to ensure that their skills were acceptable. ***Deaf*** persons fluent in American Sign Language were hired to administer the protocols to deaf participants with unique communication needs.

All of the face-to-face interviewers were trained yearly to administer and code the interview protocols in a I-day, intensive workshop. In that workshop, they were introduced to the interview form and the coding procedures; they then practiced administering and completing the interviews with project staff and with each other in role-play situations. At the end of the training, they were all required to observe a predeveloped interview, conducted by a staff person with a deaf individual on videotape, and to code the subjects' responses independently on an interview protocol. Each protocol was checked to see that responses were coded correctly in relation to the already-established codes. All interviewers were in perfect agreement with this standard. At the end of the training the interviewers were provided with, and encouraged to consult, a videotape we developed to provide information on contacting the subjects, conducting the interviews, and coding the subjects' responses.

After this training, the interviewers were assigned subjects to interview in their locales by the project coordinator. Interviewers set up appointments with subjects at mutually convenient times and administered the protocols individually. Interviewers were closely monitored by project staff on a weekly basis, and questions were resolved through telephone contact. In the few cases in which questions arose regarding the coding of a response, the project coordinator made the final decision, to minimize errors.

Specification of Variables

Variables related to successful community transition were selected from the interview protocols. A listing and description of the specific variables addressed in this study are presented in the Appendix. These variables addressed four groups, or "families," of variables: postsecondary education, employment, one general variable of community adjustment... called engagement, and social experiences. Data were recorded either on an interval scale of measurement (e.g., weekly wage) or on a nominal scale (e.g., yes/no, working vs. unemployed).

Analyses

Multiple comparisons were made within each family of dependent variables to identify differences between subgroups comprising the design variables (hearing and deaf groups, and men and women). In each case, the null hypothesis (there was no difference between hearing and deaf groups or between men and women In each dependent variable) was tested at the .05 alpha level. We should note that the .05 alpha level is somewhat arbitrary but is the convention in the social sciences (Cohen, 1988; Keppel, 1982). Two issues relative to this choice should be discussed. First, when multiple comparisons within a family of related variables are conducted, it is possible to find a significant result by chance--an occurrence called Type I error (Keppel, 1982). To minimize this problem; the Bonferroni Inequality can be applied to adjust the adopted alpha level. For example, an alpha level of .05 is chosen for a family of five related variables. As five different comparisons will be conducted, the "per comparison" alpha level should be .01 (.05/5 = .01). The problem with this approach is that it is conservative and often fails to produce results that are statistically significant, and these levels can be as subjective as an alpha of .05 (Keppel, 1982). Second, p values greater than .05 (i.e., .06 to. 15) may be suggestive of important relationships in the data (Keppel, 1982; Kerlinger, 1986), especially in exploratory studies of this type. Given the seminal nature of the present study, the choice of a per-comparison alpha of .05 seemed reasonable. Further, in the interest of hypothesis development, we have elected to point out and discuss, in the subsequent narrative, results with a p value of .06 to .15.

An analysis of variance (ANOVA), based on a 3 (Group: deaf-residential, deaf-mainstream, and hearing) x 2 (Gender: male and female) design, was used to examine variables measured on an interval scale (Keppel, 1982). The Statistical Package for the Social Sciences, ANOV A procedures (SPSS, 1989), was used in these calculations. If the F value was statistically significant, a post hoc comparison of the means of the three subject groups was conducted by using t tests. That is, if the Group variable was significant, we would conduct two comparisons: (a) hearing to deaf-mainstream and (b) hearing to deaf-residential (Keppel, 1982; Klockars & Sax, 1986).

Logistic regression (DeMaris, 1992; Hosmer & Lemeshow, 1989; Tabachnick & Fidell, 1989) was employed to analyze variables recorded dichotomously. The purpose of logistic regression is to identify a parsimonious, or the simplest, model of independent variables and their interactions that relate to the dependent variable. This is accomplished by comparing the proportion of each cell of the design. These comparisons are akin to the comparisons of averages in ANOV As. The statistics used are referred to as Log-likelihood rations (L[sup 2]), with p values being obtained by comparing these values to chi-square values. For example, based on the results of previous research, or on a scientific hunch, the researcher will develop a model of independent variables and their interaction(s) with a dichotomous dependent variable. The "fit" of this model to the dependent variable is tested. Those independent variables that are not associated with the dependent variable in a statistically significant manner are excluded from the model. Statistically significant associations between independent variables and the dependent variable are identified, resulting in a final model. If any of the selected independent variables consist of more than two levels (e.g., three groups of participants), it then is appropriate to examine that variable through post hoc procedures to specify which of the groups are statistically different from one another relative to the dependent variable.

As with the ANOVA analyses, a 3 (Group: deaf-mainstream, deaf-residential, and hearing) x 2 (Gender: male and female) design was utilized. The number of subjects included in these analyses ranged from 273 to 438Bsample sizes that far exceeded the generally accepted standard of 5 subjects per cell for this procedure (Tabachnick & Fidell, 1989). The Statistical Package for the Social Sciences, Loglinear procedures (SPSS, 1989), was used in these calculations.

We included and examined all possible combinations of independent variables in a model relative to the dichotomous dependent variable. Thus, the respective L[sup 2] was computed for the following models: Group, Gender, Group/Gender, and Group x Gender Interaction. To identify the "best" model, that is, the model that was simplest yet most statistically powerful, all models were compared to the Constant to identify models that exhibited a p value at or above the adopted alpha level. Next, if appropriate, the Group x Gender Interaction model was compared to the Group x Gender model by subtracting the respective degrees of freedom (df) and the L[sup 2] values and comparing this value--essentially, a chi-square (chi[sup 2]) statistic--to the appropriate chi-square table at the .05 alpha level. If the Group x Gender Interaction model was significantly different from the Group/Gender model, it was chosen as the "best" fit of model and data. If the Group x Gender Interaction was not significantly different from the Group/Gender model, similar comparisons of the Group/Gender model to the other models under consideration (Gender only or Group only) were conducted to identify the simplest yet most powerful model fitting the data.

If a significant Group x Gender interaction was evident, no follow-up of the main effects was conducted. If a model was chosen without interaction that included the Group variable, post hoc comparisons of the three subject groups were conducted. Specifically, the Wald statistic was used to compare the hearing group to the deaf-mainstream group and the hearing group to the deaf-residential group. As in the ANOV A post hoc comparisons, the alpha level for each of these comparisons was set at .025 (.05 alpha level/2).

RESULTS

Respondent Characteristics

Of 300 interviews attempted with deaf persons, 217 were completed (a response rate of 72%); of 309 interviews attempted with hearing persons, 222 were completed (a response rate of 72%). Table 1 presents data on the participants' demographic characteristics.

Univariate statistics were used to compare the hearing group to the deaf-mainstream and deaf-residential groups, and the deaf-mainstream group to the deaf-residential group. Statistically significant differences were found between the hearing group and the two deaf groups with regard to the presence of disabilities other than deafness, with both deaf groups exhibiting higher levels of secondary disabilities (e.g., physical disability, vision impairment, etc.) than did the hearing group. Specifically, for the hearing group versus the deaf-mainstream group, chi[sup 2] (1, n = 268) = 28.67, P = .00, and for the hearing group versus the deaf-residential group, chi[sup 2](1, n = 308) = 59.64, P = .00. Although the comparison between the deaf-mainstream and deaf-residential groups was not statistically significant, chi[sup 2](1, n = 216) = 3.09, p = .08, the result is suggestive of a difference between the two groups, with the deaf-residential group presenting a higher percentage of disabilities other than deafness (48%) than the deaf-mainstream group (36%). Finally, at the time of data collection, the hearing group was younger than the deaf-mainstream group, t(254) = -9.13, p = .00, and the deaf-residential group, t (307) = -15.03, p = .00. The deaf-mainstream group was younger than the deaf-residential group, t(185) = -2.53, p = .01.

In sum, the hearing group presented fewer disabilities and was younger than either of the deaf groups. The deaf-mainstream group, as compared to the deaf-residential group, presented fewer other disabilities and was younger.

Comparisons Among Groups

This section presents the results of the study by content area: postsecondary education, employment, engagement, and social experiences. Because of missing data and the relevance of certain questions to respondents (e.g., respondents who were not working at the time of data collection were not asked questions about their current jobs), the sample sizes vary.

Postsecondary Education. Table 2 presents findings on the two postsecondary education variables examined in the study. For "Attendance in postsecondary education (n = 438)," the results for the logistic regression analyses were as follows: Constant--L[sup 2]:493.70 (437); Group--L[sup 2]: 470.28 (435), p = .00; Gender--L[sup 2] = 491.95 (436), p = 19; Group/Gender--L[sup 2] = 468.53 (434), p = .00; and Group/Gender Interaction--L[sup 2] == 468.45 (432), p = .00. The Group x Gender Interaction model was not significantly different from the Group/Gender model as chi[sup 2] = .12, (2) p = .94, indicating the absence of an interaction. The Gender model was not significantly different from the Constant (p = .19) and was thus excluded from further consideration. Conversely, the Group and Group/Gender models were significantly different from chance and therefore were retained. A comparison between the Group model and the Group/Gender model yielded a nonsignificant chi[sup 2] =1.75, (1) P = .19, indicating that the simpler model is as powerful as the two-variable model and best fits the data. Post hoc comparisons indicated that a higher percentage of the hearing group attended post-secondary education than of the deaf-mainstream group (Wald = 14.33, 1, P == .00) or the deaf-residential group (Wald = 17.46, 1, P = .00).

For "Attendance in a 4-year college (n == 436)," the results for the logistic regression analyses were as follows: Constant--L[sup 2] = 545.84 (435); Group--L[sup 2] = 490.31 (433), P = .00; Gender--L[sup 2] = 543.32 (434), p = .11.; Group/Gender--L[sup 2] = 487.25 (432), P = .00; and Group/Gender Interaction--L[sup 2] = 485.64 (430), P = .00. The Group x Gender Interaction model was not significantly different from the Group/Gender model, chi[sup 2] = 1.61 (2), p = .45, indicating the absence of an interaction. The Gender model was not statistically significant at the .05 level, but the p value (p = .11) suggests a relationship in the data. The Group model did not differ significantly from the Group/Gender model, chi[sup 2] = 2.72, 1, P = .10, indicating that the simpler model is as powerful as the more complex model. On the other hand, this result, in concert with the results for the Gender model, is suggestive of the importance of Gender relative to this variable. Accordingly, the Group/Gender model was selected. In line with this choice, we concluded that a higher overall percentage of women than men attended 4-year colleges. Post hoc comparisons of the Group variable revealed that a higher percentage of hearing persons attended 4-year colleges than did persons from the deaf-mainstream group (Wald = 26.73, 1, P = .00) or the deaf-residential group (Wald = 31.92,1, p = .00).

Employment. Table 3 presents the results for the employment variables, recorded on a nominal scale. For "Employment (n = 339)," the results for the logistic regression analyses were as follows: Constant--L[sup 2] = 331.36 (338); Group--L[sup 2] = 276.94 (336), p = .00; Gender--L[sup 2] = 331.33 (337), P = 85; Group/Gender--L[sup 2] = 276.12 (335), P = .00; and Group x Gender Interaction--L[sup 2] = 270.93 (333), P == .00. The Group x Gender Interaction model differed from the Group/Gender model in a manner that bordered on statistical significance, chi[sup 2]= 5.19, 2, P = .08, and was chosen as the best fit to the data. Consistent with this model, men exhibited higher levels of employment than women in the hearing and deaf-residential groups, but deaf women exhibited a higher employment rate than deaf men in the mainstream group. In fact, deaf women from mainstream school programs in this study exhibited an employment rate of 83.3%, which was higher than the employment rates exhibited by the other three groups.

The following variables include fewer subjects as their associated questions were relevant only for those persons who were working. On the second variable, "Found job through self, family, or friends (n = 273)," the results for the logistic regression analyses were as follows: Constant--L[sup 2] = 328.47 (272); Group--L[sup 2] = 318.80 (270), p = .01; Gender--L[sup 2] = 325.41 (971), P = .08; Group/Gender--L[sup 2] = 314.59 (269), p = .00; and Group/Gender Interaction--L[sup 2] = 313.94 (267), P == .00. The Group/Gender Interaction model was not significantly different from the Group/Gender model, chi[sup 2] = .58,2, P = .75, indicating the absence of an interaction. Gender, although not statistically significant in the model, presented a p of .08, indicative of a relationship in the data. Comparisons of the Group model to the Group/Gender model did yield a statistically significance difference, chi[sup 2] = 4.28, 1, p = .04. Post hoc comparisons indicated that a higher percentage of the hearing group tended to find jobs on their own, as compared to the deaf-main-stream group (Wald == 5.46, 1, P = .02) or the deaf-residential group (Wald = 7.10,1, P = .01).

Given the p value of the Gender variable, it also is appropriate to note that a higher percentage of men found jobs on their own as compared to women. Specifically, the percentages for deaf women from mainstream and residential schools were roughly the same (51.7% and 52.9% respectively); and 62.5% of the deaf men from residential schools and 73.9% of the deaf men from mainstream programs found their jobs through the self/family/friends network. The rates for deaf men approximated that exhibited by hearing women (73.8%) but were lower than that reported by hearing men (82.1 %).

Table 4 presents the results for employment variables recorded on an interval scale and analyzed through ANDY A. For "Total number of paid jobs (n = 418)," the results of the analysis were as follows--F(2, 412) = 19.55, P = .00; Gender--F(l,412) = .52, P = .47; and Interaction--F(2, 412) = 5.88, P = .00. As the interaction term is statistically significant, these results should be interpreted accordingly. Hearing women reported having held more jobs since leaving high school than hearing men and women from both deaf groups reported holding fewer jobs than their male peers. Deaf women from residential programs reported an average of 1.19 paid jobs since leaving high school, and deaf men from residential programs reported an average of 1.85 paid jobs in this same time period.

Given the significant interaction, we did not conduct post hoc analyses of the Group variable. Still, it should be pointed out that the average number of paid jobs reported by persons from residential programs (2.29) and hearing respondents (2.42).

For "Length of time in current job (n = 270)," the results of the analysis were as follows: Group--F(2, 264) = 5.10, P = .00; Gender--F(l, 264) = 3.54, P = .06; and Interaction--F(2, 264) = .54, P = .59. Only the Group effect met the pre-established criteria for statistical significance. Post hoc comparisons revealed that the hearing group was statistically different on this variable from the deaf-residential group, with t(217) = 3.03, p. = .00, but not from the deaf-mainstream group, t (213) = .69, P = 49. Note, too, that the p value for Gender was .06. Thus, a strong trend is apparent, indicating that men had worked longer in their current jobs than women.

For "Average number of hours worked/week (n = 270)," the results of the analysis were Group--F(2, 264) = 1.54, P = .22; Gender-- F(l, 264) = 7.67, P = .01; and Interaction--F(2, 264) = .96, p = .39. Only Gender was statistically significant, indicating that men who were employed worked more hours per week, on overage, than did women. However, deaf women from residential programs worked the highest number of hours per week than any of the other groups.

Finally, for "Average hourly wage (n = 262)," the results of the analysis were as follows: Group--F(2, 256) = 6.49, P = .00; Gender--F(l, 256) = .26, P = .61; and Interaction--F(2, 256) = .75, P = .47. Post hoc comparisons of the Group effect revealed that the hearing group earned more money per hour than the deaf mainstream group, t(205) = 6.01, p = .00, or the deaf residential group, t(211) = 3.82, p = .00. Also, deaf women from mainstream programs earned the lowest average hourly wage, the second lowest wage was earned by deaf men from residential programs, and deaf women from residential programs earned the highest average hourly wage of any of the deaf groups.

Engagement. Table 5 presents the results for "Engagement (n = 436)." The results for the logistic regression analysis were as follows: Constant--L[sup 2] = 490.36 (435); Group--L[sup 2] = 404.29 (433), p = .00; Gender--L[sup 2] = 488.88 (434), P = .22; Group/Gender--L[sup 2] = 401.25 (432), P = .00; and Group x Gender Interaction-- L[sup 2] = 399.76 (430), P = .00. The Group x Gender Interaction model did not differ from the Group/Gender model in a statistically significant manner, as chi[sup 2] = 1.49 (2), P = .48. The Gender model was not significantly different from the Constant model (p = .22). The Group/Gender model approaches statistical significance from the Group model (chi[sup 2] = 3.04,1, p = .07). Given this, we have elected to adopt the Group/Gender model and to follow up both main effects. Post hoc comparisons for the Group variable revealed statistically significant differences between the hearing and deaf-mainstream groups (Wald = 32.83,1, P = .00), and between the hearing and deaf-residential groups 'Wald = 63.62, 1, P = .00). There results indicate that lower percentages of both deaf groups were engaged at the time of data collection as compared to their hearing peers. Men and women from deaf-mainstream settings, although exhibiting a lower rate of engagement than hearing peers (64.9% for men and 64% for women), exhibited higher rates than men (58.7%) and women (40.4%) from residential programs. Overall, a higher percentage of men than women were engaged.

Social Experiences. Table 6 presents the results for "Number of close friends (n = 425)," which was recorded on an interval scale and analyzed through an ANOVA. The results of the analysis were as follows: Group--F(2, 419) = 27.50, P .00; Gender--F(I,419) = 5.47, P = .02; and Interaction--F(2, 419) = 1.51, p = .22. Hearing respondents reported having a higher number of close friends than did either the deaf-mainstream group, t(298) = 6.53, P = .00, or the deaf-residential group, t(340) = 6.01, P = .00. The Gender effect also was statistically significant, with men reporting, on average, having a higher number of friends than did women.

Table 7 presents the results for "Happiness (n: 434)," which was recorded on a dichotomous scale and analyzed through logistic regression. The results were as follows: Constant--L[sup 2] = 348.78 (433); Group--L(sup 2] = 332.08 (432), P = .00; Gender--L[sup 2] = 347.30 (432), P = .25; Group/Gender--[sup 2]= 330.89 (430) P = .00; and Group x Gender Interaction--L[sup 2] = 326.23 (428), P = .00. The best choice is the Group x Gender Interaction model, as this model approaches statistical significance from the Group/Gender model (chi[sup 2] = 4.59, 2, P = .10), suggesting the presence of an interaction. An interaction is also visually apparent with women from both deaf groups, who indicated that they were happier than their male peers; and hearing men were slightly more happy than hearing women.

DISCUSSION

These results should be interpreted with three thoughts in mind. First, the study took place only in the Pacific Northwest, with a sample of young adults. These findings may not be applicable to other geographical locales or age groups. Second, the deaf-residential group presented a higher percentage of disabilities other than deafness and was older than the deaf-mainstream group. These two groups represent different populations, and thus direct comparisons between the two are tenuous. Third, it must be remembered that these data were gathered when the participants were 3 to 4 years out of high school. Reviews of research of the employment patterns of deaf persons over the adult years (Passmore, 1983) suggest that the cleavage between persons who are deaf and hearing peers becomes more pronounced over time.

We believe that two patterns of findings are most important and warrant discussion: (a) the differences between the hearing and deaf participants in the study and (b) the varying influences of gender on different dependent variables. First, it was evident that the hearing group outperformed the deaf-mainstream and deaf-residential groups on most variables. The deaf groups, as compared to the hearing group, exhibited statistically significantly lower rates of attendance in postsecondary training and 4-year colleges, and of employment. They had spent less time at their current jobs, earned lower wages, and worked slightly longer hours. They also were less likely than hearing peers to be engaged at the time of data collection, and they had fewer close friends than the hearing group. Findings of interest within the deaf groups focus on the employment area: The participants from deaf-residential programs, as compared to the hearing group, had held fewer paid jobs since leaving high school, and those who were employed had held their current jobs for a shorter period of time.

As compared to the results from the NLTS, the participants in this study exhibited similar rates of enrollment in postsecondary education (around 60%) and slightly lower rates of enrollment in 4-year colleges (three of the deaf groups in this study exhibited enrollments lower than the 22% enrollment ratio in the NLTS). A higher rate of employment was exhibited by the deaf groups in this study than was evident in the NLTS, ranging from a low of 45.9% for women from residential schools to a high of 83.3% for deaf women from mainstream programs, as compared to an employment rate of 43.5% for the entire sample of deaf participants in the NLTS, including 55% of the men and 29% of the women. Lower percentages of deaf persons in this study reported finding their jobs through the self/family/friend network (51.7% to 73.9%) than was found in the NLTS for all persons with disabilities (84%).

Although these results paint a less-than-optimistic picture of the overall transition experiences of persons who are deaf and who participated in this study, it is well documented that individuals who attend and complete postsecondary training can, and do, achieve employment and adjustment success at a rate comparable to hearing peers', at least in the early stages of adult life (Brown, 1987; DeCaro & Arenson, 1983; Welsh, 1986; Welsh & Parker, 1982). These positive results should be interpreted in light of the abilities of these persons to be admitted into and complete such training, as well as of the level of training and support afforded in those institutions. The present study suggests that for a sample of all persons who are deaf leaving high school, at least in this region, such experiences are not the norm, and it underscores the fact that it is incorrect to generalize the results of this study to all people who are deaf (Bowe, 1988).

Accordingly, effective programs must be afforded to all persons who need to improve or enhance their transition into society. Specifically, comprehensive school-based transition programs--extending from the elementary grades through high school--that focus on the functional work and independent living skill training of this population should be developed, evaluated, and improved. Such programs should be coupled with strong, ongoing support systems to assist persons who are deaf in their work and living endeavors over an extended period of time. For example, deaf-residential students had fewer paid work experiences than the hearing or deaf-mainstream participants. To address this issue, and because a sizable portion of this group have other disabilities in addition to deafness, many may need ongoing regular support and services to attain employment success.

To date, the bulk of the attention in education and rehabilitation for the deaf population has focused on persons attending postsecondary education programs, in particular those who enter 4-year colleges (Bowe, 1988). Clearly, not all persons who are deaf pursue and receive this type of training and its benefits. A large segment of persons who are deaf do not attend postsecondary education and have come to be labeled as "low-functioning" (we believe this is a pejorative label, but it is the term formally adopted by the federal government; see Reiman, Bullis, & Davis, 1991). There are few empirically developed and tested curricular materials or program models to address this group's unique vocational training, placement, and support needs (Bowe, 1988; Reiman et aI., 1991). The recent attention to transition and vocational preparation for this group in education (Bowe, 1988) and rehabilitation (Charttock, 1990) has stimulated interest and action in this area, and will likely result in improved service delivery.

Second, gender was related in a statistically significant manner to some of the dependent variables in the study. Deaf women from residential programs exhibited a low rate of employment (45.9%) relative to the other groups in this study, but this was still higher than that found for deaf women in the NLTS (22%). A lower percentage of deaf women from mainstream and residential settings reported finding jobs through the self/family/friend network (51.7% for main-stream settings and 52.9% for residential) than did their deaf male peers or hearing men or women. Deaf women from residential programs who were employed worked the highest number of hours per week, on average, of any group in this study (33.88 hours/week) and earned the highest average hourly wage of any of the four deaf groups ($5.59/hour). On the other hand, this same group had the lowest average number of paid job experiences since leaving high school (1.19) of any of the deaf or hearing groups. Deaf women from mainstream programs who were employed worked the lowest average number of hours (29.89 hours/week) of any of the deaf groups and earned the lowest average hourly wage ($4.30) of any other deaf or hearing groups in this study. These results are in line with earlier research (Barnett, 1982; Egelston-Dodd, 1977; Schroedel, 1987). Conversely, as compared to deaf men, deaf women from mainstream programs exhibited a high rate of employment (83.3%)--in fact, this vas the highest employment rate of any of the four deaf groups. Also, and again in relation to deaf men, a higher percentage of deaf women attended postsecondary training (66.7% for those from mainstream programs and 69.2% for those from residential programs) and 4-year colleges (17.6% for those from mainstream programs and 23.1 % for those from residential programs). These results, however, were low in relation to hearing men and women. Finally, a higher percentage of deaf women than deaf men indicated that they were happy.

The issue of how to better serve women who are deaf deserves attention. Schroedel (1987) recommended that special efforts be made to foster placement in career paths that are nontraditional and include opportunities for advancement and higher levels of learning. It also may be important to realize that fewer deaf working women in this study reported finding their jobs through the self/family/friend network. Training in self-directed job search activities to encourage self-reliance in securing employment should be explored (Long & Davis, 1986). It also was apparent that there were deaf women who performed well in their transition activities. For example, deaf women from the mainstream programs exhibited a high rate of employment, and the 17 deaf women from the residential programs who were working worked the highest average number of hours per week and earned the highest average wage of any of the deaf groups. Follow-up of these persons, to identify the factors that facilitated this success, should be conducted.

These ideas should be investigated as ways to improve the current transition service delivery system for persons who are deaf. Efforts such as these must be undertaken if all persons who are deaf are to receive the training and support they need to perform to their maximum potential as members of our society.

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TABLE 1 DEMOGRAPHICS

Variable n	Hearing 222	Deaf- mainstream 88	Deaf- residential 129
Gender	Male – 114 (51%)	37 (42%)	77 (60%)
Hearing loss prelingual (before age 3)	--	82 (93%)	127 (98%)
Presence of other disability	17 (9%)	32 (36%)	62 (48%)
Age at data collection	chi= 21.28 SD= .73	22.36 1.08	22.76 1.00

TABLE 2
POSTSECONDARY EDUCATION (PERCENTAGE ANSWERING YES)

Variable	Hearing	Group Deaf-mainstream	Deaf-residential
Attendance in			

postsecondary training (n=438)			
Gender			
Male	82.5%	62.2%	61.8%
Female	87.0%	66.7%	69.2%
Attendance at a 4-Year college (n = 436)			
Gender			
Male	46.0%	10.8%	10.7%
Female	50.0%	17.6%	23.1%

TABLE 3
EMPLOYMENT--DICHOTOMOUS VARIABLES (PERCENTAGE ANSWERING YES)

	Group		
Variable residential	Hearing	Deaf-mainstream	Deaf-residential
Employment (n=339)			
Gender			
Male	95.5%	69.7%	66.7%
Female	94.1%	83.3%	45.9%
Found job through self, family, or friends (n=273)			
Gender			
Male	82.1%	73.9%	62.5%
Female	73.8%	51.7%	52.9%

TABLE 4
EMPLOYMENT EXPERIENES – INTERVAL VARIABLES

		Group			
		Hearing	Deaf-mainstream	Deaf-residential	Total
Total number of paid jobs(n=418)					
Gender	X				
	n				
Male	X	2.29	2.42	1.85	2.16
	n	112	36	72	220
Female	X	2.58	2.19	1.19	2.12
	n	98	48	52	198
Totals	X	2.42	2.29	1.57	2.12
	n	210	84	124	418
Length of time in current job(n=270)					
Gender					
Male	X	17.11	16.68	9.16	14.94
	n	84	22	38	144
Female	X	13.60	11.62	9.47	12.60
	n	80	29	17	126
Total	X	15.40	13.80	9.25	13.85
	n	164	51	55	270

Average hours per week(n=270)					
Gender					
Male	X	32.57	34.49	33.67	33.15
	n	84	23	39	146
Female	X	27.66	29.89	33.88	29.02
	n	79	28	17	124
Total	X	30.19	31.92	33.73	31.25
	n	163	51	56	270
Average hourly wage (n=264)					
Gender					
Male	X	6.63	5.01	4.67	5.84
	n	80	22	38	140
Female	X	6.20	4.30	5.59	5.70
	n	78	27	17	122
Total	X	6.42	4.62	4.95	5.77
	n	158	49	55	262

TABLE 5

ENGAGEMENT (PERCENTAGE ANSWERING YES)

	Group		
Variable	Hearing	Group Deaf-mainstream	Deaf-residential
Engaged (n=436)			
Gender			
Male	93.9%	64.9%	58.7%
Female	91.7%	64.0%	40.4%

TABLE 6

SOCIAL EXPERIENCES – CLOSE FRIENDS

		Hearing	Deaf-mainstream	Deaf-residential	Total
Close friends (n=425)					
Gender					
Male	X	5.36	4.28	4.15	4.77
	n	109	36	74	219
Female	X	5.20	3.26	3.47	4.33
	n	108	47	51	206
Totals	X	5.28	3.70	3.87	4.56
	n	217	83	125	425

TABLE 7

SOCIAL EXPERIENCES – HAPPINESS (PERCENTAGE ANSWERING YES)

	Group Hearing	Deaf-mainstream	Deaf-residential
Happiness (n=434)			
Gender			
Male	94.6%	71.4%	75.0%
Female	90.7%	86.3%	84.6%

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APPENDIX

VARIABLE DESCRIPTIONS

Postsecondary Education

- Ever attended any type of postsecondary training? (Recorded yes/no)
- Since leaving high school, has the subject ever attended a 4-year college? (Recorded yes/no)

Employment

- Total number of paid, competitive jobs since leaving high school. (Total number recorded)
- Currently employed or unemployed? To qualify as unemployed the subject was not working and actively searching for a job. (Recorded employed/unemployed)
- How did the subject find his/her current job? Two categories were recorded: Self/ Family/Friends (i.e. I found the job by myself, through friends) and Other Services (e.g., school, vocational rehabilitation). (Recorded self/family/friend or other services)
- Length of time in current job (Total number of months recorded)
- Average number of hours worked per week in current job. (Average number of hours recorded)
- Average hourly wage in current job. (Average hourly wage recorded)

Engagement

- Currently engaged/unengaged in meaningful activities? Engagement was defined as working at least 20 hours/week in a competitive job for at least minimum wage, going to school full time, or working and going to school part time. (Recorded engaged/unengaged)

Social Experiences

- How many close friends? (Number of close friends recorded)
- How happy is the student? (Recorded happy/unhappy)

by Michael Bullis, Bruce Bull, Brain Johnson and Dawn Peters

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Abstract: Discusses the existing parallels between the teachers of ***deaf*** and teachers of children with English as an additional language in terms of perspectives on their education, their experiences of discrimination, their communication environment and the significance for them of integration at school. Use of sign language among ***deaf*** people.

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EDUCATING FOR BILINGUALISM IN DIFFERENT CONTEXTS: TEACHING THE *DEAF* AND TEACHING CHILDREN WITH ENGLISH AS AN ADDITIONAL LANGUAGE

ABSTRACT

Teachers of the ***deaf*** and teachers of children with English as an additional language have independently been debating the idea of supporting bilingual-ism as a possible goal of education. The situations of these two groups of children are quite different. This paper explores what parallels may exist between them in terms of perspectives on their education, their experiences of discrimination, their communication environment and the significance for them of integration at school. The paper concludes with an analysis of the special needs of ***deaf*** children from ethnic and linguistic minority communities.

Introduction

For most of its history, most of the UK has been a monolingual society. In the planning of the National Curriculum for England few challenged the assumption that an educated citizen would only need a good monolingual competence with some access to a second (European) language for travel and commerce. However, the idea of supporting bilingualism as a possible goal for education has been the subject of increasingly intense debate among two small groups of educators--teachers of the ***deaf*** and teachers of children with English as an additional language (EAL). In each case there has been a shift in the balance of the debate in recent years. Fewer of these teachers now place an exclusive emphasis on preparing children solely for communication in the preferred language of the majority in society. There is now more widespread affirmation of the value of supporting the use of sign language among ***deaf*** people and supporting the development and maintenance of proficiency in community languages among ethnic and other minorities. In general, there has been only limited and local progress in putting such ideals into practice. but in the enclosed worlds of each of these professional groups an increasing proportion of teachers believes that they should be (Verma et al., 1995: Baker & Child, 1993).

On the surface, it appears that there may be parallels between the interest in educating ***deaf*** children for bilingualism and the interest in bilingual education for children from linguistic minorities (Cummins, 1984; Grosjean, 1992; Gregory, 1993). In this article I plan to analyze what those parallels are and what these two groups of hard-pressed teachers may learn from each other. The analogies to be drawn are not simple ones. The situations of the ***deaf*** and of linguistic minorities are quite different. However, the arguments in each case refer to some similar sounding principles, e.g. highlighting minority rights. I hope that the account given here will suggest some useful lessons that these groups may learn from each other's experience and arguments.

This note derives partly from a study day organized 3 years ago in the Department of Psychology of University College London. This event brought together 59 teachers and educational psychologists from over 20 local education authorities. The participants heard opening presentations from Colin Baker of the School of Education in the University College of North Wales, who discussed goals and methods in the education of pupils who have EAL, and from Miranda Pickersgill of the Hearing Impaired Service in Leeds, who addressed the same theme in relation to pupils who have hearing impairment. Then, in the main sessions of the day, the participants worked in specialist groups to tackle such questions as:

- what does zzbilingualism' really mean when it is stated as a goal of education for the children we work with?;

- what do we consider are the crucial elements in the methods used to teach language/communication skills to the children we work with?;

- what are the greatest obstacles to achieving the goal and what conditions make success most likely?

At the end of the day groups spanning across the major specialist areas analysed what they had found that \they could share and what they had found that they could not share. My aim in this article is to take forward the analysis of themes that were highlighted during that study day.

Brevity and complexity are uncomfortable bedfellows. In this short paper the reader will find many general statements that appear to imply that *deaf* children and children with EAL each form quite homogeneous groups. This is not the case. The reader is asked to bear in mind that some of the general statements below would not hold for all *deaf* children, whose development is significantly affected by differences in degree and type of impairment, age of onset and other factors. The category of 'children with EAL' is similarly heterogeneous and the text must be subject to the same note of caution in that case.

Bilingualism in the *Deaf* Community and in Linguistic Minority Communities

For most of the 20th century the education of the ***deaf*** has been based on a medical! deficit perspective on deafness; to be ***deaf*** is simply and solely to be without the ability to hear. An alternative perspective on what it means to be ***deaf*** focuses on the social and cultural status of the person in a wider community of ***deaf*** people. The central differences between these two models are summarized in labels 1 and 2, drawing on notes in Pickers gill (1994) and discussions in Gregory (1993) and Hindley (1997).

At the same time many monolingual educators in the West have thought of bilin-gualism with a deficit perspective that has paralleled in some respects the medical/ deficit perspective on deafness:
monolingual ism is seen as the norm and a bilingual person is considered to face the risk of having a lower level of competence in one of the languages. An alternative, 'enrichment' perspective on what it means to have English as an additional language highlights the psychological, social and cultural advantages that bilingualism may offer. The parallel differences between these two perspectives are also summarised in Tables I and II, drawing on notes in Baker (1994) and on discussions in Grosjean (1985), Cummins (1986) and Baker (1996).

Administration Manual, 1995). Closure Status 26 indicates that a client has been suitably employed for a minimum of 90 days. Consumers who are closed "rehabilitated" (Status 26) are further coded for one of six specific work-status-at-closure categories: competitive employment, extended employment, ,elf-employment, state-agency-managed business enterprises, homemaker, and unpaid family worker. Because this study sought to evaluate consumers on the basis of whether they achieved competitive jobs or not, cases that were not closed into this category were collapsed into the noncompetitive jobs category. Consequently, there were two states of the dependent variable: competitive jobs and noncompetitive jobs.

Population

In order to derive data specific to the three target groups of interest, all VR consumers who were identified as ***deaf*** (major disability codes 231-249), late-deafened (major disability codes 253-259), and hard-of-hearing (major disability codes 261-289) were included in this study. The population for this study was thus all 15,248 *deaf,* late-deafened, and hard-of-hearing consumers closed into Status 26 by the VR system nationally during fiscal year 1997 (October I, 1996 through September 30, 1997). Of these 15,248 consumers with hearing loss, 5,543 (36%) were ***deaf****,* 592 (4%) were late-deafened, and 9,113 (60%) were hard-of-hearing. The relatively small percentage of participants who are late-deafened could be attributed to the fact that many persons who become ***deaf*** later in life do not know about vocational rehabilitation programs (Glass & Elliot, 1993). On the other hand, many consumers who are ***deaf*** or hard-of-hearing lose their hearing at earlier ages and receive special education and transition services from school systems that are aware of the purpose of VR programs.

Data Analysis

Two different tests of statistical significance were utilized in the current study: chi-square tests and logistic regression analyses. Chi-square tests are appropriate for evaluating dichotomous independent and dependent variables (Huck & Cormier, 1996). Based upon Cohen and Cohen's (1983) approach, logistic regression is the most appropriate technique for evaluating the linear relationship between two or more predictor variables (i.e., VR services) and a dichotomous dependent variable (i.e., work status at closure).

First, chi-square analyses were conducted for type of hearing loss (i.e., ***deaf***, late-deafened, and hard-of-hearing) and work status at closure (i.e., competitive jobs or non-competitive jobs). Since this analysis involved three comparison groups (i.e., ***deaf***, late-deafened, and hard-of-hearing), a statistically significant outcome does not give insight as to which populations differ from one another. To gain such insights, the researcher conducted post hoc pairwise comparisons (2 x 2 chi-square tests) between ***deaf*** and late-deafened; ***deaf*** and hard-of-hearing; and late-deafened and hard-of-hearing. Whenever two or more separate chi-square tests are conducted within a post hoc investigation, each using the same level of significance as that used in the initial chi-square tests, the chances of a Type I error will exceed the nominal level of significance (Huck & Cormier, 1996)--that is, the chances of indicating a significant relationship when there is in fact no significant relationship (Saxon, Alston, & Hobert, 1994). Thus, to guard against possible Type I errors, the researcher implemented the Bonferroni Technique; alpha levels were set at .003 (i.e., .01/3) to adjust for Type I error.

Second, logistic regression analyses evaluated the linear relationship between VR services and work status at closure. Third, chi-square tests evaluated the proportions of significant VR services received by consumers who were ***deaf***, late-deafened, and hard-of-hearing. Last, the relationship between type of hearing loss and work status at closure was evaluated for those consumers who had received those VR services that were found to be significantly associated with work status at closure. Those consumers who had not received these selected VR services were eliminated from the sample. Thus, in this study the researcher was able to examine two-way interactions among type of hearing loss, work status at closure, and selected VR services (using the chi-square test) by evaluating only those consumers who had received those selected VR services. The chi-square and logistic regression procedures of the Statistical Package for the Social Sciences (SPSS, 1989) were used in these calculations.

RESULTS

For fiscal year 1997 there were 5,543 (36%) ***deaf***, 592 (4%) late-deafened, and 9,113 (60%) hard-of-hearing VR consumers. Female participants represented 51 % of the total population served. The population consisted of an overwhelming majority of Caucasians (85%). African Americans, Native Americans, and Asian Americans accounted for 12%, 1 %, and 2% of the population, respectively. A small percentage of the population received VR-sponsored support for college or university training, business and vocational training, adjustment training, on-the-job training, transportation, and maintenance. Assessment, restoration, counseling, job-finding services, and job placement were received by 89%, 59%, 85%, 40%, and 35% respectively.

Target Groups and Competitive Jobs

An analysis of the available data revealed that 13,394 of the 15,248 participants (88%) were closed into competitive jobs following VR intervention. First, 2 x 2 cross-tabulations for each hearing-loss group (i.e., ***deaf***, late-deafened, and hard-of-hearing) and work status at closure (i.e., competitive job or noncompetitive job) were examined visually to determine the relationship (if any) among each of the variables. Cross-tabulations revealed differences among the percentages of consumers who were ***deaf*** (92%), late-deafened (82%), and hard-of-hearing (86%) closed into competitive jobs.

Chi-square analysis revealed that type of hearing loss was significantly related to work status at closure, chi[sup 2](2, N = 15,248) = 129.768, P < .01. Pairwise comparisons were nonsignificant for late-deafened versus hard-of-hearing, chi[sup 2](1, N = 9,705) = 5.187, p> .003, but significant for ***deaf*** versus late-deafened, chi [sup 2](1, N = 6,135) = 55.652, P < .003, and for ***deaf*** versus hard-of-hearing, chi[sup 2](1, N = 14,656) = 114.679, P < .003. That is, consumers who were ***deaf*** achieved competitive jobs at a significantly greater rates than consumers who were late-deafened and hard-of-hearing.

VR Services and Competitive Jobs

Second, the distributions of VR services (i.e., assessment, restoration, college or university training, business and vocational training, adjustment, on-the-job-training, counseling, job-finding services, job placement, transportation, and maintenance) were examined. Ideally (for analytic purposes) those variables should have exhibited a 50-50 split or distribution. That is, half of the participants should have been provided with each service and the other half not. Although distributions of 80%-20% are appropriate for logistic regression analyses, variables with distributions more skewed than 80%-20% (e.g., 95%-5%) should be excluded from the procedure (Cohen & Cohen, 1983). No predictor variables were excluded based on this criterion.

Third, 2 x 2 cross-tabulations between each VR service and work status at closure were examined visually to determine the relationship (if any) among each of the variables. For example, if the percentage of consumers who received job placement services and achieved competitive jobs was higher than the percentage of those who did not receive this service and achieved competitive jobs, the job placement service variable would be retained as a variable that might shed light on work status at closure. As a general rule, differences of more than 5% on the independent variable between states of the dependent variable were considered for further analyses (Bullis, Davis, Bull, & Johnson, 1995). Five variables were dropped at this point because they did not meet these criteria: assessment, restoration, adjustment, counseling, and transportation.

Fourth, phi correlations among the remaining six VR services (i.e., college or university training, business and vocational training, on-the-job-training, job-finding services, job placement, and maintenance) were calculated, as were correlations between the six VR services and work status at closure. Correlations among these variables ranged from .02 to .88. The correlation coefficient for job placement and job-finding services (r = .88) indicated that multicollinearity was an issue. Therefore, the job-finding services variable was dropped from further analyses. Correlations among the remaining predictor variables, ranging from .02 to .32, were sufficiently low to conclude that multicollinearity was no longer an issue. Correlations among the predictor variables and the criterion variable ranged from .06 to. 16.

Fifth, a logistic regression analysis investigated the linear relationship between college or university training, business and vocational training, on-the-job training, job placement, maintenance, and work status at closure. Of the five VR service variables entered into the logistic regression, college or university training (p < .01, r[sup 2] = .01), business and vocational training (p < .01, r[sup 2] = .02), on-the-job training (p < .01, r[sup 2] = .02), and job placement (p < .01, r[sup 2] = .03) were significant predictors of competitive jobs (see Table 1).

Target Groups and Selected VR Series

Sixth, chi-square analyses were run between type of hearing loss (i.e., ***deaf***, late-deafened, and hard of hearing) and the selected VR services (i.e., college or university training, business and vocational training, on-the-job training, and job placement). Chi-square analysis revealed that type of hearing loss was significantly related to college or university training, chi[sup 2](2, N = 15,248) = 276.217, p < .01 (see Table 2). Post hoc pairwise comparisons were nonsignificant for late-deafened versus hard-of-hearing, chi[sup 2](1, N = 9,705) = 4.675, P > .003, but significant for ***deaf*** versus late-deafened, chi[sup 2](1, N = 6,135) = 50.391, P < .003, and ***deaf*** versus hard-of-hearing, chi[sup 2](1, N = 14,656) = 252.966, P < .003. That is, consumers who were ***deaf*** were provided with college or university training at a significantly higher rate than consumers who were late-deafened and hard-of-hearing.

Chi-square analysis revealed that type of hearing loss was significantly related to business and vocational training, chi[sup 2](2, N = 15,248) = 100.092, P < .01 (see Table 2). Pairwise comparisons were again nonsignificant for late-deafened versus hard-of-hearing, chi[sup 2](1, N = 9,705) = .040, P > .003, but significant for ***deaf*** versus late-deafened, chi[sup 2](1, N = 6,135) = 12.807, P < .003, and ***deaf*** versus hard-of-hearing, chi[sup 2](1, N = 14,656) = 96.349, p < .003. Once again, consumers who were ***deaf*** were provided with a significantly higher proportion of business and vocational training when compared to consumers who were late-deafened and hard-of-hearing.

Chi-square tests indicated that type of hearing loss was significantly associated with on-the-job training, chi[sup 2](2, N = 15,248) = 153.955, p < .01 (see Table 2). Pairwise comparisons were nonsignificant for late-deafened versus hard-of-hearing, chi[sup 2](1, N = 9,705) = .001, p > .003, but significant for ***deaf*** versus late-deafened, chi[sup 2](1, N = 6,135) = 16.922, P < .003, and ***deaf*** versus hard-of-hearing, chi[sup 2](1, N = 14,656) = 149.030, P < .003. That is, consumers who were ***deaf*** were provided with significantly more on-the-job training than consumers who were late-deafened and hard-of-hearing.

Chi-square analysis revealed that type of hearing loss was also significantly associated with job placement chi[sup 2](2, N = 15,248) = 601.235, p < .01 (see Table 2). Post hoc analyses (pairwise comparisons) were once again nonsignificant for late-deafened versus hard-of-hard of hearing, chi [sup 2](1, N = 9,705) = 6.317, p > .003, but significant for ***deaf*** versus late-deafened, chi[sup 2](1, N = 6,135) = 124.710, P < .003, and ***deaf*** versus hard-of-hearing, chi[sup 2](1, N = 14,656) = 561.243, p < .003. As was the case with college or university training, business and vocational training, and on-the-job training, job placement was provided to a significantly higher proportion of consumers who were *deaf* than of consumers who were late-deafened and hard-of-hearing.

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By Elaine Jones, Trry Badger, University of Arizona

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Best Part

MATHEMATICS VOCABULARY: PERFORMANCE OF RESIDENTIAL *DEAF* STUDENTS

In the field of ***deaf*** education, there is much emphasis on the teaching and reaming of reading and language. Reading and language are thought to be the basic foundations of any ***deaf*** child's success in education, regardless of whether the ***deaf*** child uses sign language, the oral method, or any other communication mode. Through the entire educational gamut, the ***deaf*** child experiences this emphasis on reading and language and is continually pushed to improve the use and comprehension of standard English. Although this emphasis is evident in the education of ***deaf*** students, the outcome is that the average reading level for ***deaf*** persons at age 20 is at approximately the third or fourth grade level (Allen, 1986).

Deaf Students' Vocabulary Achievement

Within the subjects of English reading and language there are two components: vocabulary and syntax. Hasenstab & McKenzie (1981) indicate that of these, vocabulary may be the area of primary concern in the reading development of ***deaf*** students. Furthermore, various studies of educational achievement that use tests such as the Stanford Achievement Test have shown that ***deaf*** students usually score lowest on vocabulary or word meaning subtests. For example, scores for Word Meaning are consistently low, which indicates the difficulties that understanding English vocabulary pose for ***deaf*** students (King & Quigley, 1985).

Deaf Students' Mathematical Achievement

In addition to the weakness in vocabulary, ***deaf*** students also demonstrate difficulty in performing mathematics. ***Deaf*** students' overall performance on standardized achievement tests does indicate a relatively greater ability in mathematics compared to other academic/cognitive areas. However, mathematics achievement by ***deaf*** students is below the norms established for hearing students (DiFrancesca, 1971). The difference in achievement between hearing and ***deaf*** students is greatest in mathematical application, which includes more language than does mathematical computation (Bloomquist & Allen, 1988). This lower achievement could be for many reasons. Emphasis on language development within the curriculum could detract from efforts to develop other academic areas. Teachers of the ***deaf***, according to Johnson (1977), rely heavily on drill and practice for mathematics instruction, with little encouragement of conceptual understanding of mathematical ideas. It is possible that ***deaf*** education

Comparing Experiences of *Deaf* Children and Children with EAL

Discrimination

Autobiographical accounts and survey data provide evidence that many members of each of these groups experience discrimination because of difference. At a personal level this may be expressed through name calling, teasing and social exclusion, at a group level through under-employment and educational exclusion. When they are compared with many other minorities that have such experiences, a distinctive feature of the process of marginalisation for these two groups is that it focuses on problems of communication (Daigle, 1995). Each group faces particular challenges in its interaction with the majority because of limited proficiency in the majority's main means of communication. In this respect their situation differs from that of some other minorities who face severe discrimination, such as African Caribbean youths or gay and lesbian adults. However, where deafness or speaking English as an additional language is associated with the extra marker of ethnic difference, it seems likely that the experience of discrimination will be particularly acute. In this case the usual issues around communication will be exacerbated by issues relating to racism (Sharma & Love, 1991; Meherali, 1994). The situation of ***deaf*** children from ethnic minorities is discussed below.

The Communication Environment

Normally the social and communal context of communication is the key issue that differentiates the experience of ***deaf*** children from that of children with EAL. In the case of most children with EAL their family and local community is likely to speak their community language (Ll). It may be an anglicized, local or transitional form of the language, but it will be widely shared locally, it will be acquired in early childhood as a natural first language and it can provide a strong foundation for the acquisition of a second language later. The first and second languages will differ in phonology, morphology, syntax and vocabulary, but in essentials they are of the same kind.

In the case of the 5-10% of ***deaf*** children who are born to ***deaf*** parents their family is likely to communicate using a sign language such as BSL. Although such languages share the central features of all human languages, transfer of learning between a sign language and a spoken/written language is a more complex process involving more new steps for the child than transfer of learning between two spoken/ written languages. If ***deaf*** children who have BSL as a first language are to become bilingual in English, they face a greater challenge than a hearing speaker of Punjabi or Gujerati who seeks the same objective.

• t the challenges facing ***deaf*** children who develop a fluent command of BSL as a first language at home are much more manageable than those facing the great majority of ***deaf*** children who are born to hearing parents (Kampfe & Turecheck, 1987). It is not uncommon for individuals in this group to wait several years before they encounter a fluent speaker of a visual language--the only kind in which they can easily and quickly become fluent. The impact of this on the child's development of communication skills may be traumatic and profound. Key factors seem to be the attitudes of the parents to the communication process, their understanding of the child's needs and their ability to respond to those needs. There is evidence that, compared with ***deaf*** parents, hearing parents of ***deaf*** children are likely to:

• during interaction with the child as an infant show fewer of the positive facial expressions that can be considered the visual equivalent of the warm tone of voice that hearing parents typically employ with their infants;

• take less care to ensure that their infant is in a position to see their hands, face and eye gaze during con versation;

• achieve a lower rate of success in maintaining their infant's attention during joint play (Gregory & Hindley, 1996; Hindley, 1997).

If aspirations to bilingualism are to be realised, it will be necessary to intervene with such families at a very early stage (Van der Lem, 1987).

Integration at School

For both ***deaf*** pupils and those with EAL there has been a firm shift over recent years towards inclusive educational provision that is more fully integrated with the provision made for other pupils in primary and secondary schools. The motivation for this has been well rehearsed and there are convincing and fundamental principles underlying the trend. At the same time it is important to recognise that for each group a fully inclusive education may bring losses as well as gains. Because of discrimination and prejudice on the one hand and problems of communication on the other, integration in the wider community may not be wholly successful. Moreover, what is achieved may be won at the expense of the communal support and strengthened sense of identity that individuals can enjoy as members of a family, community and culture which share certain of their characteristics--the ***deaf*** child of ***deaf*** parents, the black person living and working within a black community. There may be a failure to teach key skills needed by the minority group and methods of teaching may suit some but not all the integrated children. The learning of Ll and access to the curriculum through L1 may be denied them in a way that reduces the children's overall success with the curriculum.

There have been strong reactions to these problems. Some leaders of ethnic and religious minority communities hope to negotiate the 'opting in' of independent black or religious schools. This will enable them to offer the perceived advantages of segregated schooling to their target population. At the same time some members of the ***deaf*** community see the closure of many schools for the ***deaf*** as a threat both to ***deaf*** culture and to the development by ***deaf*** children of an appropriate sense of personal identity.

Going to a mainstream school I was always seen as the odd one out, but I'd give my child the chance to go to a ***deaf*** school where they wouldn't have to put up with the same public reactions that I had to. (Graham in Viner, 1990)

Deaf Children from Ethnic and Linguistic Minorities

The education of ***deaf*** children from ethnic and linguistic minorities presents particular challenges. This group is growing fast, but there has been relatively little systematic research on its size and characteristics. An NCDS survey 10 years ago suggested that about 18% of special schools and just over 9% of units and services in mainstream schools had pupils with hearing impairment from a non-European background. The community languages that were most commonly used by their families were Punjabi, Urdu, Gujerati, Bengali, Chinese and Hindi (Speedy, 1986). A later survey of children under 5 years of age with sensori-neural hearing loss in England found that 18-8% of that population were from ethnic minority backgrounds, of which the largest group (12.2%) were from the Indian, Pakistani and Bangladeshi communities. In the area covered by the 12 Inner London boroughs over half the affected population was from ethnic minority backgrounds. These proportions are markedly higher than would be expected from the communities' numbers in the general population (Turner, 1996). Over-representation was particularly marked in the case of children from South Asian communities. In studies in which the over-inclusive category 'South Asian' has been analysed further, it has emerged that it is the Pakistani and Bangladeshi groups who show the highest rate of over-representation (Parry, 1996; Powers, 1996).

There are serious concerns about the ability of existing services to respond to the specific needs of ***deaf*** children from ethnic minority communities (Sharma & Love, 1991). Diagnosis may be delayed because) professionals are reluctant to trust black parents' observations about their children or are confused about normal patterns of development in their community. For example, an Indian parent quoted in that report told how they took their son to the GP because his speech was developing slowly. 'His response was to say that our bilingual household was holding back his language development' (Sharma & Love, 1991, p. 17). In the services covering the areas surveyed by Turner (1996) the number of qualified staff able to converse in a minority language was very small indeed. For example, 10 of the 12 Inner London boroughs had no such staff at all, although over half the children they served came from ethnic minority communities. This is an issue often highlighted by South Asian parents when asked to evaluate the services offered to them, e.g. the parent interviewed by Meherali and quoted in Gregory et al. (1991, p. 58).

Surveys in both England (Powers, 1996) and the USA (Holt & Allen, 1989) have shown that ***deaf*** children from black and ethnic minority communities perform significantly less well on some measures of academic achievement than white ***deaf*** children. Powers' analysis of English GCSE results suggested that it was 'not quite ethnic background itself that is the significant factor but rather the language used in the home' (p. 114). But commentators have identified a wider range of factors that may disadvantage these groups of ***deaf*** pupils. Their analyses draw equally on insights deriving from specialists in ***deaf*** education and specialists in EAL and multicultural teaching.

In addition to tackling the staffing and discrimination issues noted earlier, the following elements have been suggested as important to a strategy for the future:

- measures to reverse negative teacher attitudes and expectations.
- improvements to parent/teacher communication as a basis for partnership;
- the introduction and celebration of the of the cultural traditions of ethnic minorities in the curriculum.
- the clarification of difficult issues in school language policy, e.g. resolving uncertainties over the relative emphasis to be placed on English or a community language as a child's first oral language, developing soundly based guidance for parents on the use of language(s) with their child at home;
- support for teachers to foster sensitivity and commitment in helping children to develop a strong dual personal identity as black and ***deaf***,
- information materials on *deaf* education in community languages and information materials on minority religions and cultures in BSL (Cohen et al., 1990; Meherali, 1994).

That list focuses on school measures. There are many social factors outside school that may also have the effect of depressing the children's educational performance. The most important of these are probably the obstacles that deafness places in the way of what Meherali has called the 'immunisation' provided by familiar and positive relationships within the family and immediate ethnic group against the threats posed outside in the broader society. Many children in ethnic minority communities experience socio-cultural dissonance stress and a sense of incongruity caused by belonging to two cultures--a minority culture and the dominant culture of the society where one lives (Chau, 1989). For ***deaf*** children in hearing families in minority communities the salve of communicating about those stresses with others who share them may not be easily available.

A full response to the needs of deaf children from black and ethnic minority communities will therefore have three prongs--respecting their hearing impairment, their family's cultural and religious values and language and their unique and vulnerable identity as black and ***deaf,*** an identity that may be threatened by discrimination equally within the black community and within the ***deaf*** community. In every context educating for bilingualism must confront issues of personal and group identity. **In** the context of work with children who are black and ***deaf*** these issues are presented in an exceptionally complex and challenging form.

TABLE 1. Alternative perspectives on deafness and on linguistic minorities
Legend for Chart:

A - Medical/deficit perspective on deafness
B - Social/cultural perspective on deafness

	A B
Implications of deafness	Inherited or acquired deficit of sensory apparatus which inevitably leads to dependence on the hearing Potential for autonomous membership of a community of ***deaf*** people with a shared language. culture and heritage
Meaning ascribed to bilingualism	Term little used. Attention focused on limitations to communication through spoken and written English Fluent use of BSL as a first language with spoken or written English as an additional language
Cognitive development	Specific and important deficits compared to hearing children The normal range of ability to learn if given means of access to what other children access through hearing
The conditions for effective communication	Successful compensatory strategies to overcome hearing impairment suffered by one party, e.g. cued speech. cochlear implant Both parties using a wholly visual mode of communication

Legend for Chart:

A - Deficit perspective on having English as an additional language
B - Enrichment perspective on having English as an additional language

	A B
Implications of having an additional language	Stresses potential problems in linguistic development and social adjustment Stresses the enhancement of the child's linguistic. social and cultural range
Meaning ascribed to bilingualism	A bilingual speaker is seen simply as the sum of two monolinguals A bilingual speaker is seen as having a flexible communicative competence with a range of monolingual and bilingual conversants
Cognitive Development	Perceived risks of cognitive impoverishment because of 'overloading' or a limited concept vocabulary in second language Cognitive advantages highlighted such as cognitive flexibility, social perspective taking

TABLE II. Implications of these perspectives for the Education Service

Legend for Chart:

A - Medical/deficit perspective on deafness
B - Social/cultural perspective on deafness

	A B
Chief goal for education	Successful participation in hearing society on hearing society's terms Linguistic and cultural diversity ***Deaf*** identity
Favoured educational approaches	Oral/aural approaches Total communication and bilingual (and bicultural) approaches
Educational treatment of sign language/BSL	Excluded or discouraged Actively incorporated (or. at least. passively accepted)
Employment of deaf adults in schools	To a limited degree and in a support role Extensively, at every level, treating their skills and knowledge as central to the educational task and stressing their value as role models
Tends to ignore or play down	(i) Disability rights (ii) Evidence of the failure of oral/ aural approaches with many ***deaf*** children (i) Implications of the great variations that exist in degree of hearing impairment (ii) Evidence of the success of oral approaches with some deaf children

Legend for Chart:

A - Deficit perspective on having English as an additional language
B - Enrichment perspective on having English as an additional language

	A B
Chief goal for education	Successful participation in mainstream society on the majority community's terms Linguistic and cultural diversity A confident identity as a bilingual speaker
Educational treatment of community languages	Children are discouraged from speaking community languages together at school as that will prevent them from practising English The use of community languages is encouraged to foster learning across the curriculum and. aloug with learning about a range of cultures. to reinforce positive messages about the social and cultural status of minorities
Employment of native speakers of community languages in schools	No explicit policy on the issue Normally employed in support roles Extensively, at every level, treating their skills and knowledge as central to the educational task and stressing their value as role models
Tends to ignore or play down	Minority/ community rights Exceptional challenges posed by multilingual school populations

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COUNSELING NEEDS OF STUDENTS WHO ARE *DEAF* AND HARD OF HEARING

The National Center for Health Statistics (1994) estimated that more than 25 million people have hearing impairments ranging from hard-of-hearing to deafness. Due to economic, legal, and social changes in the United States, residential education of the ***deaf*** has become less popular with parents and educators. More parents are directing their children who are ***deaf*** and hard of hearing to inclusive public school settings. Inclusion, or placing students with special needs in regular schools, is now the norm. For many students with profound hearing loss, this movement toward inclusion has resulted in considerable consternation (Gjerdingen & Manning, 1991).

This article examines the unique challenges that children who are hard of hearing and ***deaf*** experience in the public school settings. We focus on aspects of providing an optimal educational environment, laws related to special needs of the ***deaf***, explanations of the technology and tools available to the ***deaf*** and hard of hearing, and exemplary counseling practices to meet the needs of ***deaf*** children.

Section 504 of the Rehabilitation Act of 1973, followed by the Education for All Handicapped Children Act (EAHCA) of 1975 (now known as Individuals with Disabilities Education Act of 1991 or IDEA), provided landmark legislation for people with disabling conditions by charging the local, state, and federal governments with responding to the needs of American children with disabilities (Guthrie, n.d.). Appropriate education was defined as placing children in programs that best fit their needs, as opposed to attempting to fit children to existing programs (Cohen, Swerdlik, & Smith, 1992).

IDEA calls for the involvement of parents in the development of the child's individual education program (IEP), and guarantees the parents due process and the right to be heard, informed, and involved, and to challenge decisions. The legislation also guarantees the students and parents the right to use their native language during school conferences or to have access to an interpreter at the expense of the school if use of an interpreter is necessary for the student to benefit from his or her educational experience.

Each state has rules and regulations governing eligibility for special services. The Maine Department of Education Special Education Regulations (1992) provided specific guidelines concerning students who are ***deaf*** and hard of hearing and are eligible for assistance under IDEA as "a student who is ***deaf*** has a hearing impairment of approximately 90 dB in the better ear, that is so severe that with or without amplification the student is unable to process language through hearing and that adversely affects the student's educational performance" (p. 9). A hard of hearing student is defined as "a student who is hard of hearing, has a hearing loss of approximately 25-90 dB in the better ear, which is either permanent or fluctuating, and which adversely affects the student's educational performance" (p. 9).

To understand how decibels (dB) are used in measuring hearing loss, the following explanation is given (Meadow, 1980):

Zero decibel hearing level represents the softest sound that can be heard by most young adults with normal hearing; whispered speech is about 20 to 30 decibels heating level; conversational speech is at the level of 60 to 70 decibels, and 120 decibels is extremely loud and may be painful to people with normal hearing. (p. 3)

THE *DEAF* COMMUNITY AND *DEAF* CULTURE

Understanding the world of students who are ***deaf*** and hard of hearing is important in helping with the transition to an inclusive educational setting. If a student has previously attended schools where the entire student body is ***deaf***, then a ***deaf*** community and a ***Deaf*** culture have shaped the student's educational experience.

Most members of the ***deaf*** community have common values and shared experiences (Nye, 1993). Membership does not relate to the degree of hearing loss but rather to identification with the community (Padden & Humphries, 1988). The ***deaf*** community refers not only to persons with audiological conditions affecting their capacity to hear, but also to people who identify themselves as members of this particular group who share the common language of American Sign Language (ASL) as a major component of their common culture (Rainer, Altshuler, & Kallmann, 1969; Steinberg, 1991; Woodward, 1972).

We have chosen to use the terms ***Deaf*** and Hard of Hearing throughout this article out of respect for the preference of the ***Deaf*** community in the United States. The word ***deaf*** (with a small d), is used to describe the medical condition of not being able to hear. Individuals who were born ***deaf*** or who lost their hearing in childhood often grow up using American Sign Language as their first language, and form partnerships and social relationships primarily with others who culturally identify themselves as ***Deaf*** These adults do not see themselves as faulty hearing people. They see themselves as belonging to a minority ***Deaf*** culture with their own language and community. This ***Deaf*** community rejects the medical model of treating individuals as broken hearing people. Instead, they have chosen to embrace the word ***Deaf*** (with a capital D) and use it with pride.

The ***Deaf*** culture is defined by several interrelated areas, such as ***deaf*** attitude, support of ***deaf*** social and political organizations, and language (Nye, 1993). ***Deaf*** attitude relates to the importance within the ***Deaf*** culture of participating in ***deaf*** clubs, ***deaf*** church services, ***deaf*** sports teams, and ***deaf*** group activities. Prejudice against hearing persons, including the expectation that ***deaf*** persons will only marry other ***deaf*** persons, plays a role in ***deaf*** attitude. For example, in ***deaf*** humor, a hearing person is often the fall guy or dummy of the story.

A second aspect of ***Deaf*** culture is involvement in specialized social and political organizations. This support can include local, state, and national associations such as ***Deaf*** Olympics, the National Association of the ***Deaf***, and the World Federation of the ***Deaf*** National and state organizations can assist the counseling professional by providing useful resource materials, such as handouts, reading lists, information packets, and databases (see the Additional Resources). Comprehensive directories of national organizations, institutions, and publishing companies can be obtained from the National Information Center on Deafness and the National Association of the ***Deaf***.

American Sign Language (ASL) is the manual communication used by most ***deaf*** Americans (Smith, 1981). However, ASL is not universal, and ***deaf*** persons from different countries communicate using different sign languages. The gestures or symbols in sign language are organized in a linguistic way. Each individual gesture is called a sign. Each sign has four parameters: the hand shape, palm orientation, the location of the hand, and the movement of the hands. How the signs of ASL are combined are unique to it and are not based on English. ASL differs from English and is more similar to the way French sign language is constructed (Riekehof, 1987). Several sign systems have been invented by hearing people, including Seeing Essential English (SEE I), and Signing Exact English (SEE II). These invented codes are called Manually Coded English (MCE) systems. They are codes that attempt to represent English, and are not separate languages. For an in-depth analysis of ASL versus forms of coding for spoken English, see Baker and Cokely (1980).

American Sign language should not be confused with finger spelling. Finger spelling is used most commonly for proper and product names, and by hearing people who do not know how to convey a thought or concept using ASL. Finger spelling consists of various finger and hand positions for each of the letters of the alphabet. This alphabet is called the American Manual Alphabet.

Communication etiquette is another part of ***Deaf*** culture related to language. To a hearing person, ***deaf*** persons may seem intrusive or overly personal in their questions; however, they are trying to find and develop a connection with the person with whom they are communicating. For example, on first greetings and introductions between ***deaf*** persons, the initial information transfer usually includes the questions: Are you ***deaf****!* What is your first and last name? Which ***deaf*** school did you attend? Where are you from? (Repass & Snow, personal communication, August 14,1994).

Other aspects of communication etiquette are important to the professional working with a ***deaf*** client. "Non-manual behaviors, such as use of eye contact and physical proximity, attention-getting maneuvers, greeting and parting rituals, and concepts of privacy and confidentiality may differ significantly from behaviors in mainstream American culture" (Steinberg, 1991, p. 381).

Conventions of communication etiquette and polite conversation in ASL are different from those in the spoken English of most American communities (Hall, 1983). Movements of a signer's eyes, face, and head help form signs, act as adverbs and adjectives, and serve as grammatical signals (Baker-Shenk, 1985). Sign language is so animated and affect-laden that a signer may be negatively misunderstood. "For example, a subtle twitching of the nose signifies 'yeah-I-know,' and a furrowed brow may represent a question" (Steinberg, 1991, p. 381). A person communicating in sign language commonly maintains intense and continual eye contact and may touch a listener, stomp, or vigorously wave an arm to get another person's attention. Non-verbal signals could easily be misinterpreted as tics or involuntary movements, abnormalities of eye contact, or difficulty maintaining boundaries (Steinberg, 1991, p. 381).

EDUCATIONAL CHALLENGES

Gallaudet University suggests four principles to be considered for successful inclusion: (a) It is important that ***deaf*** students have access to a wide variety of educational environments, (b) students should have access to all special services required for normal educational growth, (c) the student and parents should have access to and freedom of choice of educational programs, and (d) the high cost of education of ***deaf*** students should not be a limiting factor (as cited in Strack-Grose, 1992).

Cohen et al. (1992) suggested that low achievement levels are not the result of learning deficits related to deafness but of problems in the communication patterns between teachers and the ***deaf*** students and the absence of an accessible language in the classroom setting. According to Steinberg (1991), "It is important to note that few *deaf* students in the mainstream are currently educated in a linguistically accessible environment" (p. 385). As a result of receiving incomplete and inaccurate language input, ***deaf*** children, when communicating in English, often leave out critical linguistic elements needed for comprehension by another individual. Teachers need to plan how students who are ***deaf*** and hard of hearing can access the communication taking place all around them in the classroom. The individual needs of each student must be considered when making choices about language and communication modes. Many students who are ***deaf*** will benefit from the primary use of American Sign Language in the classroom, the exposure of ***deaf*** children to ***deaf*** teachers and other ***deaf*** adult language models, and instruction in English as a second language (ESL) through reading and writing. Educators will find it helpful to refer to the guidelines for serving students who are ***deaf*** and hard of hearing, produced by the National Association of State Directors of Special Education (1996) for additional guidance.

A counselor using a qualified interpreter can do several things to clear up some communication difficulties, depending on the language abilities of the child: Ask questions to clarify any confusions; speak slowly, but in complete simple sentences; if, after repeating something once or twice, the client still has difficulty understanding, change the language being used, try drawing, or limit the use of idiomatic phrases (Strack-Grose, 1992).

Techonology Available to the Deaf and Hard of Hearing

Technology has improved the quality of life for people who are ***deaf*** or hard of hearing. It has enhanced their ability to communicate more easily and has allowed the ***deaf*** and hard of hearing to be more alert to safety concerns within their environment. Technology also has reduced dependence on heating persons for interpretation of environmental cues and communication. Some technological devices used for communication by individuals who are ***deaf*** and hard of hearing individuals are described below.

Amplifying telephone receivers. Telephone receivers with a volume control built into the hand grip allow persons with hearing loss to amplify the incoming conversation.

Closed-caption machines. CCM's allow the viewer to display subtitles on the TV screen for television shows and videotapes.

Captioned films. Public Law 85-905 established the Captioned Films Program to provide for distribution of captioned films through appropriate agencies. Certain copyright restrictions apply to showings.

Hearing aids. These instruments consist of a receiver and an amplifier for sound. Ail sounds in the environment are amplified with the same intensity and, unfortunately, a hearing aid cannot sort, process, or discriminate among sounds. Aids deliver louder sounds to the ear. If a person's hearing organ distorts sound, then wearing a hearing aid will not mean that the person can hear normally. Aids do not correct hearing, but increased loudness helps some people by enabling them to hear a voice even though they may not be able to understand the words being spoken.

Telecommunication devices for the ***deaf*** *(TDD's).* TDD's include instruments such as the teletypewriter (TTY) that allow ***deaf*** persons to communicate over the telephone. Such a device must be located at each end of the telephone conversation. Some devices type the message on a paper roll, whereas others display the message on an electronic calculator-like display panel with the letters moving from right to left across a screen.

Phone relay services. This service provides a telephone operator intermediary to facilitate communication access between a person who is using a TTD/TTY and a person who is using a regular telephone.

Wire electronic amplification system. This system consists of an instructor microphone/transmitter, binaural student FM receiver, and a recharging unit. The system allows the hard-of-hearing student to have personal amplification in the classroom setting.

Hearing dogs. Specially trained dogs that help their owners respond to sounds in the environment, for example, doorbells ringing, kettles whistling, and the like.

Light and motion alarm systems. Alarm systems use flashing lights or vibrations to signal a ***deaf*** person about a fire, a ringing phone, a crying baby, a wake-up alarm, or a ringing doorbell.

Interpreters. The role of the interpreter is that of a cultural-linguistic mediator. Interpreters are expected to perform in either direction--from visual signed to spoken language or from spoken to visual signed language. The interpretation can take place immediately (simultaneous interpretation), or with a brief delay (consecutive interpretation) (Van Cleve, 1987).

The Registry of Interpreters for the ***Deaf***. (RID). RID is a national organization with a membership of over

4,500, whose purpose is to provide interpreting and transliterating services in the United States and its territories (RID also has members from other nations). RID has 18 separate certifications that address various skills and audiences, for example, interpreting in legal settings and performing arts. There is also special certification for interpreters who are ***deaf*** A directory, which lists certified members by states, chapter officers, and suggested reimbursement for professional services, is available from RID for a nominal fee (Schwartz & Turner, 1995).

RELEVANT SOCIAL AND PSYCHOLOGICAL DEVELOPMENT ISSUES

There are several social and psychological developmental issues of which counselors should be aware when working with ***deaf*** students who attend public schools with hearing peers. ***Deaf*** children and adolescents may have less positive notions about themselves than do comparable groups of hearing peers (Moores & Meadow-Orlans, 1990). Because social development and language acquisition are intertwined, ***deaf*** children whose language skills are retarded will have fewer opportunities for social interaction, both within and outside the family (Meadow, 1980).

Social maturity is another area affected by impoverished language skills. When a child has a disability, significant others in his or her environment may scale down their expectations for social achievements appropriate for particular ages and stages of development. ***Deaf*** children who are language deficient tend to communicate very little about the past and future. Their focus is usually limited to things or events that are immediate in time and space. This narrow focus to current actions may create the possibility for anxiety in ***deaf*** children. Lack of communication about the probable course of future events makes it difficult for adults to reassure the child about the possible outcomes of present happenings that may be disturbing. This does not hold true for ***deaf*** children who are raised in a linguistically accessible environment by parents who are ***deaf***, or some ***deaf*** children who have a history of excellent communication patterns developed since birth.

Isolation and alienation from peers in inclusive classrooms is another issue for the ***deaf*** student. Due to the language barrier, there are usually limited social interactions with hearing peers that could foster feelings of belonging and friendship. Unfortunately, there often is also a lack of opportunity for students who are ***deaf*** to be with ***deaf*** peers because it is unusual to have more than one ***deaf*** child in a public school classroom.

PSYCHOLOGICAL TESTING AND THE *DEAF* AND HARD-OF-HEARING STUDENT IN PUBLIC SCHOOL

Concerns about testing people with disabling conditions have become increasingly prominent in recent years (Cohen et al., 1992). It is incumbent on the counselor who interprets assessments to consider whether learning experiences leading to the development of preferences and competencies have been stereotyped by expectations of behaviors considered appropriate for women and men, for racial and ethnic minorities, on the basis of socioeconomic status, or for people with handicapping conditions. (American Psychological Association, 1985).

Testing individuals who are ***deaf*** and hard of hearing presents unique challenges. Persons who are ***deaf*** and hard of hearing often cannot respond to verbal directions included as part of most tests and cannot respond verbally because of severe language deficits that often accompany hearing loss (American Psychological Association, 1985). It is the responsibility of the test administrator to provide clear and understandable instructions to the test-taker. If the hearing loss is mild, amplification of the examiner's voice through the use of hearing aids or electronic amplification apparatus for the person being evaluated may be required. However, if the individual cannot hear normally with the use of hearing aids, the communication problem may be solved by one or more of the following: (a) present written instructions at a reading level appropriate to the person being evaluated, (b) conduct the examination with the use of a certified interpreter, or (c) pantomime instructions and questions if the tester is knowledgeable about communicating nonverbally (Cohen et a1., 1992).

Although a small minority of people who are ***deaf***, as well as those deafened later in life, may respond to English-based questionnaires, many prelingually deafened individuals find these instruments confusing and misleading (Steinberg, 1991). A counselor should be aware that because of the difficulty of the ***deaf*** child's understanding of the English language, existing personality inventories and self-administered questionnaires are not useful in evaluating persons who are ***deaf*** (Steinberg, 1991).The following are reading problems commonly encountered by children who are ***deaf*** and hard of hearing that may affect their ability to understand tests (Strack-Grose, 1992; Wood, Wood, Griffiths, & Howarth, 1986):

Picking out key words in sentences. To do this, the person usually must be able to relate the first sentence to the second, and so forth. Children who are ***deaf*** and hard of hearing tend to be word readers; they may pick out individual words, but not necessarily the key word. They may get the word meaning but not the conceptual meaning.

Determining the main idea of a paragraph. This skill requires combining abstract ideas and concrete facts from the story and determining which one, or which combination of these, expresses the main idea of the paragraph. The problem here may be twofold: difficulty with knowledge of the vocabulary, or with knowledge of the linguistic structure being used, or both.

Establishing causal relationships. ***Deaf*** children with limited language proficiency often do not understand time words, phrases, and cause-and-effect relationships.

IMPLICATIONS FOR COUNSELING

Understanding cultural norms of the ***Deaf*** community is essential when counseling a ***deaf*** client. A counselor should be aware of notable behaviors in children who are ***deaf*** that differ from behaviors of children who are hearing. If misunderstood, these behaviors can be interpreted by an observer as behavioral disorders, tic syndromes, or oppositional behaviors (Padden & Markowicz, 1976). For example, children who are ***deaf*** tend to ask more personal questions than children who are hearing, and they expect answers to their questions.

ASL is a very physical and visual language. While communicating, children will touch, flick lights to get one another's attention, and use waving motions. Students will bang on tables to get a person's attention, or bang objects to hear or feel the vibrations. Eyes also are easily fatigued by the strain of maintaining constant visual attention, which may cause children to easily tune out. Merely looking away may result in missed information.

Incidental information and shared knowledge are limited for typical ***deaf*** and hard-of-hearing students who grow up with hearing parents, and they will have many gaps in general knowledge. Unlike hearing children, *deaf* children do not overhear adult conversations, TV, radio, and the news. They only know what is directly and specifically taught or communicated to them. ***Deaf*** children of ***deaf*** parents present a different profile. They tend to have better general knowledge as they are able to overhear adult conversations more readily.

In view of the behaviors and communication needs of students with hearing deficits, the following suggestions will assist the counselor (Strack-Grose, 1992; Wood et al., 1986):

Speak in a natural manner. Articulate clearly but do not exaggerate. Keep books and hands away from your face. Try not to move around too much when communicating, because this makes it harder to lip read.

Avoid asking yes or no questions. Also, make sure you have the student's visual attention. When the child does not understand you, rephrase a sentence rather than repeat it. Encourage the child to ask for repetition if he or she does not understand. Make a practice of having the ***deaf*** and hard-of-hearing student repeat information to check for understanding.

Avoid using single words or incomplete sentences. Use synonyms. Use a misunderstood word in a simple sentence. Use opposites to emphasize examples. Explain by writing at a lower level, or dramatize and use all types of visuals. Remember that the deaf and hard-of-hearing student may become fatigued more easily during interpreted communication because of the amount of attention required on the student's part.
The physical environment is also important. Seating should be facing each other and the student should be allowed some freedom to move around. Face the student when you speak. Stand facing the window (generally) with the ***deaf*** and hard-of-hearing student's back to the window, so the light will be on your face rather than in the student's eyes. A void seating the child near windows, doors, or hallways because excessive noise is distracting. It is important to remember that hearing aids amplify all sounds.

CONCLUSION

Culturally effective school counselors are truly eclectic in their counseling approach. They are aware of characteristics of counseling that cut across many schools of thought. The culturally diverse counselor is aware of and sensitive to his or her own cultural "baggage," values, and biases and how these might affect clients (Baruth & Manning, 1991; Sue, 1981). To provide a safe and nurturing counseling environment, the sensitive counselor is also aware that students who are ***deaf*** and hard of hearing bring their culture's special aspects with them as well, such as ***deaf*** attitude, support from and connection to ***deaf*** social and political organizations, and a unique language (Nye, 1993).

Flexibility is of primary importance for the school counselor to meet the student's needs. The counselor must be aware of any necessary special arrangements or available technologies that will facilitate the usefulness of the counseling process. Working with students who are ***deaf*** and hard of hearing and included in regular public school classrooms may be the ultimate challenge, requiring exploration of the nature of the relationship between thought and language and between the communication of thought and the development of personal identity. Early intervention and education, family participation, the level and quality of communication (Lawrence, 1979), socialization, development of trust, positive self-esteem, self-image and self-concept, and appropriate role models are important factors in meeting the needs of the demand hard-of-hearing student (Steinberg, 1991).

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ADDITONAL RESOURCES

Gallaudet University
800 Florida Avenue, NE, Washington, D.C. 20002

National Association of the ***Deaf*** (NAD)
814 Thayer Avenue, Silver Spring, MD 20910 (301) 587-1788

National Center for Law and the ***Deaf*** Gallaudet University, 800 Florida Avenue, NE, Washington, D.C. 20002, (202) 651-5373

National Information Center on Deafness Gallaudet University, 800 Florida Avenue, NE, Washington, D.C. 20002
(202) 651-5373

Registry of Interpreters for the ***Deaf***, Inc. 8630 Fenton Street, Suite 324, Silver Spring, MD 20910
(301) 608-0050

By Leslie K. Harris, C.E. VanZandt & Toni H. Rees

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Abstract: Presents the poem 'The Conversation of the Deaf' AN: 4087159
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THE CONVERSATION OF THE *DEAF*

When one ***deaf*** person meets another,
the door that shuts
the ear will be, close at hand,
flung wide.
Hand will listen to hand,
and these hands are
he thoughts that free them. Through the supple fingers
the hard-of-hearing play piano.
The bars of the song, for so long iron,
will be bent,
like branches boys swing on. They're the ping-pong balls
on jets of water.
Theirs is a dance inheritance, an identity that
unites them as their hands waltz together,
all ears.
Through these strings of flesh
They pluck a tune.
The bone staves and the spaces between them are chords,
an ancient language so lively
that's a piercing, when one sees through them,
better than sound.
Their culture’s well-stocked by the alternative speech
of the dullard's hands,
the comely hands that construct a bridge
between solitudes.
We feel pity, we do, but in their story
every gesture's a handshake.
In a wind outstretched the prodigal twigs
caper warmly
on the kiss of their leaves, and they're drawn, a nation, to be tuned
into knowing each other truly.
And in a trunk they'll become a community by bearing fruit,
a tongue's petals.
And through boughs that accentuate the earth
They'll listen to seeing.

By Bobi Jones s h

Translated by Joseph P. Clancy

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Subject(s): INCLUSIVE education -- Case studies; BLIND-deaf children -- Education -- Case studies
Source: Journal of Visual Impairment & Blindness, Apr99, Vol. 93 Issue 4, p197, 14p
Author(s): Sall, Nancy; Mar, Harvey H.
Abstract: Presents information on a case study which described the inclusive education program of a student with ***deaf***-blindness on the basis of extensive classroom observations and interviews. Overview of the study; School program; Observational procedures; Components of the educational program; Essential factors for inclusion.
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IN THE COMMUNITY OF A CLASSROOM: INCLUSIVE EDUCATION OF A STUDENT WITH DEAF-BLINDNESS

Abstract: This case study describes the inclusive education program of a student with ***deaf***-blindness on the basis of extensive classroom observations and interviews with parents, teachers, administrators, and peers. Critical factors associated with the program's success included direct administrative involvement, teachers' and peers' problem-solving skills, adaptation of materials and school activities, effective teaming, consideration of the physical environment, and adoption of attitudes that support inclusion.

In its evolution, the concept and practice of educational integration has undergone several shifts to reflect changing insights about social opportunity. The call to educate students with disabilities in the least restrictive environments was formalized by the Education for all Handicapped Children Act of 1975 (renamed the Individuals with Disabilities Education Act in 1990 and reauthorized in 1997). Mainstreaming was then viewed as an opportunity for students, as a collective, to progress toward the regular classroom, the destinations of individuals being determined by the classification of their special needs. As systems of special education expanded, the observation that the least restrictive environments were nearly always segregated environments (see, for example, Gartner & Lipsky, 1987) eventually led to a revised view of main streaming in which the social inclusion, and not merely the physical presence, of each student in a school was emphasized.

Recognizing that youngsters with disabilities tended to be socially isolated or less interactive than their peers in educationally integrated settings, educators and researchers (see, for example, Guralnick & Groom, 1987; Strain, 1984) have devoted increasing attention to the promotion of social opportunity and interactions among students with and without disabilities. These now-voluminous efforts to understand spontaneous and enhanced social interactions between students with and without disabilities have given rise to both a theory and pedagogy of social competence (see Hating & Romer, 1995; McEvoy, Odom, & McConnell, 1992).

Yet there are still many concerns about the inclusion of students with ***deaf***-blindness. The central issues are how general educational programs are designed to meet the needs of students with hearing and visual impairments, how special services are provided in regular school settings, and how accommodations are made to include students in typical class activities (Cloninger & Giangreco, 1995; Ingraham, Daugherty, & Gorrafa, 1995). Furthermore, as Goetz (1995, p. 6) noted, a critical element in the successful inclusion of students with ***deaf***-blindness is the teacher's ability to strike a balance between the "academic outcomes of schooling," such as learning specific mathematics skills, and the "social participation outcomes of schooling," which include developing friendships and social supports.

Students who are identified as ***deaf***-blind are heterogeneous in their degree of hearing and visual impairments, mode of communication, mobility, cognitive skills, and the educational programs they attend. In addition to their sensory impairments, those who are ***deaf***-blind may also have mental retardation, physical impairment, central processing problems, or speech and language impairment (Ward & Zambone, 1992).

In New York State, nearly 1,200 students with ***deaf***-blindness are registered under the federal child-count program (M. Appell, project director, New York State Technical Assistance Project, personal communication, December 2, 1997). The majority attend specialized programs for students with disabilities, including special classes, separate schools, or residential school programs designed to serve children with visual or hearing impairments. At the time this study began, only eight students with ***deaf***-blindness were known to be enrolled in fully inclusive, regular classrooms throughout New York State. As Romer and Haring (1995) noted, there are differences between the inclusion of students with severe disabilities and those with ***deaf***-blindness. Only within the past 5-10 years have the unique issues regarding the inclusion of students with ***deaf*** blindness been addressed.

Mitch was one of the first students with ***deaf*** blindness in New York State to attend his neighborhood school full time. This article presents a case study that describes Mitch's educational program, its successes, and the challenges for Mitch and his family, educational team, and peers. It analyzes the essential components of a dynamic, ongoing process in the development and implementation of an inclusive education program for a student with ***deaf***-blindness. Many factors that are unique to educational programs for students who are ***deaf***-blind can contribute to their success or failure. Goetz (1995) described several specific factors related to school administration, educational "teaming," peer relationships, related services, family involvement, and academic support. In this article, these factors are examined with respect to their impact on instructional practices and the student's academic and social needs.

Mitch

"What happened when the canary flew into the electric fan? It became shredded tweet." So goes one of Mitch's favorite jokes. Mitch is well known in his school as a child with a penchant for jokes, riddles, ditties, and rhymes. He collects them, memorizes them, and tells them to small audiences of appreciative peers. Mitch, who is ***deaf***-blind, was 12 years old and a fifth grader in his community school at the time of the study. He had attended the school since kindergarten.

His parents and teachers described Mitch as having near-average academic abilities but immature social behaviors with associated problems in his social relationships. Throughout the study, Mitch participated in all school activities with his peers. However, aside from telling jokes to his classmates, his social interactions during these activities were often limited.

Mitch was diagnosed during infancy as having retinal vascular aplasia, which resulted in total blindness in both eyes. A sloping moderate-to-severe bilateral sensorineural hearing loss was not identified until he was 3 years old, and the etiology of the hearing loss is unknown. Mitch uses a cane to move around independently, reads Grade 2 braille, and wears bilateral hearing aids with an FM unit for amplification in the classroom. He communicates expressively and receptively through spoken language.

As an infant and toddler, Mitch received early intervention and vision services at home. His first school experience was an integrated preschool program for children with and without visual impairments. With support from the New York State Commission for the Blind and Visually Handicapped, Mitch began the regular education kindergarten program with other 5-year-olds in his local school. As he advanced through the primary grades, his parents and teachers became increasingly concerned about his academic and social progress.

When Mitch was 9 years old, he repeated the third grade because of his social immaturity. Whenever he became frustrated, he tended to cry. He needed frequent support from the teacher to work on classroom assignments and showed little interest in interacting with his classmates. Before Mitch entered the fourth grade, his parents began to question whether his academic needs were adequately addressed in a general education setting. Similarly, the school staff were not confident about their abilities to continue to provide the extensive supports and services he required. Furthermore, an independent psycho educational evaluation had recommended that Mitch should attend a special school program designed for children with visual impairments or ***deaf***-blindness. In response to these concerns, Mitch's parents contacted AFB to get information about resources, support, and options for his school program.

Through AFB, Mitch's mother was informed about a federally funded project entitled "Social Relationships of Children and Adolescents with ***Deaf***-Blindness," based at S10 Luke's-Roosevelt Hospital Center in New York City. The purpose of the program was to examine the development and maintenance of social interactions and relationships between students with ***deaf***-blindness and their peers. Specifically, the project sought to develop, apply, and evaluate strategies to promote social interaction and relationships between students with ***deaf***-blindness and other students with or without disabilities.

When Mitch's parents contacted AFB, this project was beginning to conduct observational research in several schools in the New York City metropolitan area. Mitch's parents subsequently contacted and met with project staff members to discuss Mitch's educational situation. The project offered to provide support to Mitch and his teachers for social interactions and relationships. Shortly thereafter, it was decided that Mitch would enroll in the fourth grade of his school for the following academic year. To date, he continues to attend his community school without support from project staff.

Mitch lives at home with his mother, father, and older sister in a small suburban town on Long Island, about 80 miles east of New York City. The house is on a quiet street where neighborhood children often ride bicycles to their friends' houses. Families who live in this community represent a wide range of socioeconomic groups, but the majority are middle income.

Mitch's mother and father, both professionals, have always been involved in the community. They have also made a strong commitment to creating opportunities that enable Mitch to interact socially with other children of his age. Thus, Mitch attends Sunday school with other children his age and participates in after-school swimming and chorus. Although Mitch's parents are satisfied with these programs, they would like him eventually to develop interests in activities that will bring him closer to his peers outside school or that he can do on his own, such as fishing.

School Program

The local school district includes one primary elementary school and an upper elementary-middle school. High school students attend regional schools in neighboring towns. The upper elementary-middle school that Mitch attends serves approximately 650 students, about 50 of whom receive some form of special educational service.

Mitch's fifth-grade class had 24 students, which is an average class size for the school. Like many school districts in New York State, the school district in Mitch's community contracts with the Board of Cooperative Educational Services (BOCES) to provide specialized educational services to students with disabilities. Although BOCES has its own school facilities and educational staff to serve students with severe disabilities, the administrators in Mitch's school are interested in educating students with disabilities in their schools. Therefore, several students with disabilities (including students with cerebral palsy, Down syndrome, and severe learning disabilities) have been enrolled in general education classrooms throughout the years.

Each year, an assistant teacher assigned to Mitch works with him and the general education classroom teacher. As the school district conceived it specifically for this program, the assistant teacher's responsibility is to adapt materials and lessons for Mitch, provide direct support, and work with other related service providers. The assistant teacher, who has a bachelor's degree in elementary education, also works with other students in the classroom.

Mitch's educational program was designed to accommodate his academic and social needs through a combination of classroom-based and individual instruction. Although he spends the majority of his school day with his peers in the classroom, he does have some pull-out services. He receives specialized instruction three times per week in the resource room, where he works with a special education teacher in a small group on writing, reading, comprehension, and problem-solving skills. In addition, he receives one-on-one instruction in the resource room 25 minutes each day, during which time he completes his school assignments and other academic activities. Mitch also has individual and small-group speech and language therapy several times a week to enhance his general language and conversational skills.

In school, Mitch receives orientation and mobility (O&M) instruction twice a week for trailing and cane skills and braille-computer instruction daily in the morning. Each morning before the official start of the school day, he has individual braille instruction for 45 minutes. He works with an instructor who teaches him to use his brailler and computer and helps translate textbooks and other material from print to braille.

Other than these services, Mitch is with his classmates in social studies, science, language arts, mathematics, physical education, and health. Assistive technology and adapted materials playa large role in enabling him to complete his schoolwork. He independently uses a brailler in the classroom, a computer equipped with a speech synthesizer, a talking calculator, a talking dictionary, and brailled books and maps.

Observational procedures

Extensive information was collected to help identify and assess changes in Mitch's educational program. Nine visits were made to the school during the year. Each school visit included interviews with both the classroom teacher and assistant teacher and several observations of Mitch with his peers in various school and classroom activities (such as a small-group activity, gym, and recess). A schedule was developed that specified the frequency, length, time, and location of observations, as well as the social and physical contexts in which observations were made.

Observations were conducted by at least one, and usually two, members of the research project following a specific time line (for example, three half-hour observations on one day, every three to four weeks). The data consisted of detailed notes of these observations, as well as information obtained from Mitch's teachers and classmates. Of major interest were changes in the quality of social interactions and relationships between Mitch and his classmates, instructional methods and activities, and accommodation in the physical environment.

Two informal tools were also developed to gather information about the classroom environment and the quality of peer relationships over the course of the year. One tool, the Activity and Environmental Survey, a Likert-type rating scale, was designed to help organize observational data about specific factors in the physical and social environment of the school and classroom related to Mitch's degree of involvement and how they changed in response to Mitch's needs during the year. Ten scale items were created to rate the degrees to which, for example, classroom materials were adapted, opportunities for interaction were available, and assistance was provided to increase participation. The rating scale was used by members of the research project in various contexts (such as small-group activities and recess) where there were natural opportunities for social interaction between Mitch and his peers.

The other tool, the School Peer Network, examined changes in the quality of peer relationships over the year. The teacher was asked to rate, on a scale of I to 6, the type of relationship Mitch had with each classmate (1 = nonfriend to 6 = best friend). This measure was completed at the beginning and end of the year, and comparisons were made between the two administrations.

In addition, the project designed a form for collecting field notes, which served to guide observations and the collection of specific qualitative aspects of the student's interactions. Sequences of behaviors and interactions between Mitch and his classmates were recorded verbatim by the researcher. Field notes were collected in conjunction with the Activity and Environmental Survey and were used to describe specific details of context, including identification of individual classmates involved in interactions, grouping patterns and seating arrangements, and the teacher's role in facilitating interactions.

Data analysis involved the integration of information gathered from field notes, the Activity and Environmental Survey, and the School Peer Network. Observational notes and interview data were thematically analyzed to identify and develop an understanding of the salient problems and issues, effective practices, and ongoing concerns relevant to Mitch's educational program. Specifically, two members of the project reviewed field notes from observations and interviews, as well as ratings on the Activity and Environmental Survey and the School Peer Network, to abstract the common themes that emerged during each school visit (for instance, Mitch's lack of participation in certain activities, the adaptation of curricula and classroom materials, and the appropriateness of peers' attempts to involve and assist Mitch).

Components of the program

The information obtained during classroom observations and interviews was broadly categorized into four domains--administrative support, team and teaching process, inclusion, and peer involvement--that most closely incorporated the themes that emerged during the data analysis. The information included in each domain represented the types of issues and concerns that typically arose during the study.

ADMINISTRATIVE SUPPORT

The school principal is directly involved in Mitch's educational program. He has worked closely with Mitch's parents and educators since Mitch entered the school as a kindergarten student. Over the years, he facilitated Mitch's enrollment in the school by giving the appropriate supports and accommodations. He also called periodic meetings to review Mitch's progress and needs, as well as the staffs concerns, even though the meetings were not mandated.

The principal also carefully selected Mitch's primary teachers. Near the end of each academic year, Mitch's prospective teacher was chosen on the basis of such factors as experience, interest, background, and teaching style, and team planning meetings were initiated to prepare for the following academic year. Mitch's classmates were also reviewed by the principal and current teacher, so that some would continue with Mitch into the next year whereas others would be assigned to different teachers. Classmates were selected on the basis of several factors and were not necessarily those who were the most comfortable or friendliest with Mitch. Rather, care was taken to choose classmates who could be socially supportive but not overprotective or too "nurturing."

The school administrators anticipated several concerns regarding Mitch’s social interactions and relationships as he moved into the upper grades. First, inevitable limitations would be placed on the principal in selecting peers and teachers in the upper grades, since students change from one period to another and interact with different teachers and classmates in each subject area. Even under the best circumstances, it took Mitch a long time to learn the names of his peers (well into the academic year). Second, ensuring that Mitch's peers continued to offer assistance, support, and social involvement would be critical. Third, Mitch would need to adjust to many different teachers. Fourth, presumably the same degree of communication that Mitch's teachers achieved in the past would be more difficult to maintain as a result of the team's complexity. These issues were identified by the administrators as a challenge in terms of how they could continue to provide the same level of support and collaboration as in the elementary grades.

The principal had never regarded Mitch's program in his school as "inclusive." Rather, he viewed the school simply as the place where Mitch would receive the best education. When Mitch entered the middle school with a different principal, the elementary school principal continued to be involved in his program and worked closely with Mitch's teachers, parents, and consultants.

TEAM AND TEACHING PROCESS

The principal constantly elicited input from the staff and outside specialists regarding various issues and problems related to Mitch's educational program. These recommendations helped the educational team make decisions, both major and minor, about necessary changes or adaptations in the delivery of services. For example, in an effort to accommodate Mitch's unique needs without reducing the amount of time he was in his classroom, they scheduled Mitch's braille instruction in the morning before the school day began. Mitch also worked in the resource room during the classroom "independent work" period while his peers similarly worked individually or in small groups.

In addition, the principal, teaching staff, consultants, and private instructors worked together to identify needed equipment and adaptations to promote Mitch's learning and participation. For example, the school purchased an auditory scanner that allowed Mitch to use the same reading materials as his peers, saving valuable time previously spent brailling the texts.

Mitch's classroom teachers learned to work closely with his assistant teacher. All the teachers assumed "fluid" roles that enabled them to change their degree of direct involvement or teaching responsibilities according to the particular moment, need, or activity. For example, although the assistant teacher's primary responsibility was to provide support to Mitch, she sometimes conducted class lessons while the classroom teacher worked directly with him. By teaching the entire class certain lessons, as well as assisting other students during work time or small-group projects, the assistant teacher was seen less as "Mitch's helper" and more as another teacher in the classroom.

The assistant teacher also recognized that for Mitch to be a member of the class, she needed to step away during certain situations and give him time and space to be with his peers. She came to understand when to provide direct assistance to Mitch and when to move away. By doing so, she was able to help Mitch achieve more independence in the classroom, which resulted in greater social and learning opportunities for him and his peers. This general strategy has been documented as effective for supporting social inclusion (see, for example, Hunt, Alwell, Farron-Davis, & Goetz, 1996).

Mitch's teachers similarly adjusted to the concept of working as a team. They were prepared to collaborate with members of the research project on social relationships, as well as Mitch's braille instructor, O&M instructor, speech therapist, and others. The teachers may have gained some benefits from the involvement of the Social Relationships Project, which helped organize both formal and informal team meetings and provided informational resources (such as videotapes, books, and articles on inclusion). Mitch's teacher described the interactions among the personnel this way:

Initially I thought my classroom would be like Grand Central Station, but now I find that the team planning we've received from St. Luke's [Social Relationships Project] and from the resource people has been such a feeling of community--a feeling of togetherness. I think the kids feel it in the class.

One frequent concern of Mitch's educational team was the coordination of O&M services. As was mentioned, Mitch received O&M instruction twice a week at school and once a week at home from two instructors from two agencies. The school instructor taught Mitch basic skills on the school grounds, while the home-based instructor worked on skills required in the community and the home. However, the two instructors had not communicated with each other and had been teaching Mitch different techniques. For example, two issues of concern were whether Mitch should use his cane in the school building and the arc of the cane as Mitch moved from side to side. It was difficult for the school principal to force the two instructors to communicate, since they both came from agencies outside the school. Mitch's parents also had several unanswered questions about which techniques or strategies would be the most effective for Mitch. During the fifth grade, coordination of O&M services was a recurring issue.

INCLUSION

It is important to recognize that in a regular school environment, social opportunities can be missed if the physical design of the classroom and school fails to address accessibility issues. Creating a barrier-free environment is essential for the participation of students with disabilities in all aspects of school life (Grenot-Scheyer, Coots, & Falvey, 1989). Mitch's teachers learned the significance of the arrangement of the physical environment for his social accommodation, including his interest in activities, ability to work with peers, sense of belonging, and independence. Through trial and error, they found which desk arrangement best accommodated Mitch's dual sensory impairments and promoted his opportunities for interacting with peers.

At the beginning of the year, Mitch sat in one corner of the classroom to be close to his assistive equipment (brailler, computer). However, his teacher sensed that Mitch was socially isolated in this location and moved him closer to the center of the room. In the middle of the year, the seating arrangement was changed again because Mitch's teacher thought that Mitch tended to interact more with his assistant teacher than with classmates, since his desk was near the assistant teacher's. Consequently, the assistant teacher's desk was relocated. Later, when the teacher again thought it was important to change Mitch's seat, the entire classroom's desk arrangements were changed so that all the students, not just Mitch, could work together more effectively in small groups.

Other accommodations were also made. The school purchased for Mitch a laptop computer with adaptive devices for blind users, a talking calculator, and a talking dictionary. Mitch did not require adaptive physical education. In gym, his teacher included him in games and sports by having him participate in all exercise routines and by assigning him specific roles in team sports (such as a designated server in volleyball). In an effort to make the hallways more accessible to Mitch, staff members decided to braille all the signs on classroom doors indicating the room numbers and teachers' names. The braille labels made it easier for Mitch to travel the hallways independently and raised the other students' awareness of the needs of students with disabilities.

Such changes were documented using the Activity and Environmental Survey. Over the course of the year, a general trend was identified that revealed overall positive changes (higher ratings on the survey) with respect to Mitch's opportunities to interact with peers, the quality of communication between Mitch and his peers, the degree of Mitch's participation in a given activity, peers' attempts to involve and appropriately provide assistance to Mitch, the teachers' attempts to facilitate interaction, the physical arrangement of the environment, and adaptation and appropriateness of materials.

The balance between providing Mitch with appropriate accommodations, on the one hand, and promoting his independence, on the other hand, was one of the more complex issues for Mitch's educational team. ;here were occasional differences of opinion between Mitch's parents and members of the school staff regarding the degree of assistance Mitch needed. At times, Mitch's parents were concerned that he was not being given sufficient opportunities to learn skills or perform tasks independently. In contrast, Mitch's teachers thought that promoting his independence was important, but that it was sometimes necessary to assist him directly so he could keep pace with his classmates. For example, Mitch was able to get his books, papers, and computer together to start a lesson, but unless assistance was provided, he often did not begin the lesson at the same time and in the same place as his peers.

INVOLVEMENT WITH PEERS

Each year, issues were raised about Mitch's ability to interact with his peers and to maintain positive social relationships. During the first part of the fifth grade, some students often turned and stared at Mitch when he made unexpectedly loud remarks; cried after becoming frustrated; or engaged in "stereotypic" behaviors, such as vigorously rolling his head back and forth. As the year progressed, however, the classmates tended to ignore these behaviors. A few of the boys occasionally worked with Mitch when he cried, explaining to him that talking about what had upset him was better than crying, and the crying incidents decreased.

Mitch was also sensitive to loud noises, such as bells going off in the hallway between periods. To help him become less frightened, a few students walked with him one day, to "desensitize" him to the bell when it rang. Mitch's teacher also involved his peers in solving certain problems regarding his participation in classroom and school activities. For example, Mitch's classmates noticed that during chorus, while the other students were singing, Mitch either sat or stood alone. Mitch's teacher asked the students to help consider solutions to the problem. The students decided that they would help braille the music sheets and rehearse with Mitch during recess so he would be familiar with the material. Mitch's teacher credited the use of these peer-planning sessions in bringing Mitch into the community of the classroom.

It is also important to note that several of Mitch's peers accepted his unique behaviors. When Mitch is frustrated or tired, he tends to engage in socially inappropriate behaviors, such as crying, hand flapping, eye poking, or talking to himself. During the interviews, some classmates commented on these behaviors, calling them "weird"; they used the term not to reject or make fun of Mitch, but to describe behaviors they openly recognized and accepted as being different. They even advocated that Mitch's privacy and right to engage in these behaviors should be respected.

Peer problem solving and peer tutoring have been identified as successful methods for promoting the inclusion of students with severe disabilities (Villa & Thousand, 1992). By using these strategies, Mitch's classmates learned to provide support and assistance in ways that encouraged his participation and increased his independence. For example, various students helped Mitch in the reading group, to read mathematics problems aloud, and in the lunchroom. Mitch's teacher and principal were concerned that Mitch's peers might view him as a younger student and that their interactions would focus on his need for help, rather than for socializing. Indeed, observations during the year confirmed that in the majority of interactions between Mitch and his peers, Mitch was given some form of help.

Yet over time, a noticeable shift occurred in the qualities of Mitch's involvement with peers. These interactions became less "assistive" and more truly social, as defined by mutual interests. In one observation, for instance, a boy sneaked up on Mitch, tapped or poked him, and then backed off, leaving Mitch to wonder who had approached him. Both Mitch and the boy appeared to enjoy this game in which Mitch's blindness was obviously a critical element. Later in the year, Mitch's teacher identified this boy as one with whom Mitch had developed a close relationship.

Although Mitch does not initiate interactions, he is receptive when someone takes an interest in him. Consequently, relationships last only as long as the peers continue to show interest. However, as was evident from an analysis of Mitch's beginning and end-of-year social networks, the depth of the relationships Mitch had with his classmates changed over time. At the beginning and end of the fifth grade, the School Peer Network was administered to the classroom teacher in an effort to identify and examine changes in Mitch's peer relationships. Overall, the teacher's subjective ratings of the degree of friendship (for example, the change from acquaintances to friends) between Mitch and 70% of his classmates improved. Despite these positive changes, it is interesting to note that aside from the occasional birthday party, Mitch was rarely invited to other children's homes, and few classmates visited him at his home.

Toward the end of the year, four peers were interviewed together about their relationships with Mitch. During this open-ended interview, which lasted about an hour, they described some of their initial thoughts when they met Mitch: "It was kind of different. I never met someone who was blind. I never met someone who has a disability." "I was scared because I didn't know how I'd handle it when I first met him, but then it felt good when I knew I could be friends with him." Mitch's peers unanimously agreed that the community school offered the best educational program for Mitch because he would be with people he knew and would learn more important things for the future. They added that it was also good for them to "get used to other people." Mitch's peers were also asked what things Mitch could not do because he was ***deaf*** blind. After a pause, one boy replied "rollerblading," but then quickly retracted it after he noted that Mitch could rollerblade if his classmates helped him the right way.

Essential factors for inclusion

Inclusive education programs are often designed by identifying the needs of a child and determining what services and supports the child requires in an integrated setting. Goetz's (1997) compilation of 11 case studies of such programs for students with ***deaf***-blindness identified a number of specialized services and supports that are unique to this population. These services and supports include the use of brailled and audiotaped materials, collaboration between vision specialists and classroom teachers, training peers in sign language, consultation from a technology specialist to design or adapt computer equipment, facilitation of social networks, and support from an interpreter-tutor.

Table 1 presents a summary of critical factors in Mitch's educational program. Each factor represents a synthesis of observations and interviews in which one common theme or "quality" was reflected. Associated with each factor are specific actions or outcomes that typify how the theme was directly expressed. Some actions or outcomes are those that may be expected of teachers or administrators in any school setting, inclusive or not. Yet, there were also many unique outcomes associated with the program's success that are often overlooked. For example, several of Mitch's classmates intuitively knew that Mitch would not seek company during recess, so they usually took the initiative in playing with him.

It is apparent, however, that although specialized services and supports are necessary, they are not sufficient to ensure the success of a program. Essential factors for success have as much to do with the qualities of a program and personnel that are not reflected in the identification of needed supports. These qualities include, for instance, educators' beliefs and attitudes regarding inclusive education, concepts of teaching, problem-solving skills, creativity, and ability to work cohesively as a team.

With respect to Mitch's educational program, these qualities, which, of course, cannot be prescribed in an Individualized Education Program, had a significant impact on Mitch's experiences of success, as well as those of his teachers and peers. For example, although Mitch was a member of the school chorus, his participation did not actually become meaningful until his classmates and teacher recognized the need to make accommodations and assume extra responsibilities (to braille the music and rehearse with Mitch).

That such "indicators" of quality are the critical factors that can lead to the success or failure of an inclusive program has been well documented in the literature (see Goetz, 1997; Meyer, Eichinger, & ParkLee, 1987). The critical factors for Mitch revolved around not only instructional methods and resources, but issues concerning his active social participation. Therefore, it was essential not only for Mitch's teachers, but for the principal and other students in the school, to recognize the importance of their roles in facilitating Mitch's sense of belonging.

Across observations and interviews, it became evident that there was one unifying theme: the sense that each person around Mitch viewed himself or herself as a member of the school community. This theme is also reflected in Table 1, which shows the primary person or group who was involved in each action or outcome associated with the critical factor. The identification of these individuals or groups emphasizes that all members of the school, not just the student and teacher, are part of a dynamic interactive system that can contribute to a program's success. Even when the parent-school relationship was challenged, neither Mitch's parents nor the school personnel lost sight of Mitch's best interests.

Earlier it was noted that at the time the study began, only a few students with ***deaf*** blindness were enrolled in full-time inclusive education programs in New York State. The authors speculate that school administrators, general and special educators, and parents may think that the needs of students who are *deaf-blind* are so complex that they cannot be met in general education settings (Liberty & Haring, 1995). Indeed, students with ***deaf***-blindness often require specialized equipment and personnel, as well as unique services, some of which may not be readily available in a school district. It is important to recognize that Mitch's educational program was not without such challenges. Yet, rather than view these challenges as insurmountable, the school administrators and educational team constantly engaged in identifying critical factors that would increase Mitch's membership in the school community.

Although it is generally agreed that full inclusion of students with disabilities, including those with ***deaf***-blindness, is achieved when necessary supports are provided to ensure their academic and social belonging in typical classroom communities (Haring & Romer, 1995), much more emphasis needs to be placed on how schools function as community systems. The authors suggest that multiple tiers of critical factors should be analyzed when an inclusive education program is evaluated. In addition to teaching methods and educational resources, such tiers may include administrative systems (such as district wide inclusive education programs and the use of consultants and mission statements); peer networks (for example, a student's active involvement in weekend social activities with peers); and systems of perceptions, attitudes, and beliefs (such as a teacher's view of the student as an equal member of the classroom). Future research on the school as a community is likely to find that the more successful inclusive education programs for students who are ***deaf***-blind go well beyond the support of a student's instructional needs.

Table 1 Critical factors in Mitch’s inclusive education program.

Legend for Chart:

A - Critical factors
B - Examples of actions or outcomes
C - Primary responsibility

A	B C
Adapting materials activities	Making a tactile tic-tac-toe board for Mitch's use during recess Peer Assigning role of "designated server" to Mitch during a volleyball game Physical education teacher Individualizing lessons that correspond to group activities Classroom teacher

Administrative involvement	Handpicking Mitch's teacher for the next year Principal Purchasing assistive equipment, such as a brailler and computer School board Allotting time for periodic team meetings Principal
Alternative communication	Student passing the FM microphone to allow Mitch to hear all comments Peers, teacher Peers identifying themselves by name when approaching Mitch Peers
Attitude of belonging	Peer stating that neighborhood school is the best place for Mitch Peers Principal advocating that Mitch belongs in a community school Principal Emphasis on social learning and interaction with peers Classroom teacher
Effective teaming	Parents participating as members of the educational team Parents Identifying outside consultants for assistance and resources Parents/Principal Anticipating Mitch's needs for the transition to junior high school Principal Eliciting input to identify needed equipment, adaptations, and materials Principal, teachers Teachers and service providers collaborating formally and informally Classroom teacher
Instructional strategies	Balancing the need for support and the need for independence Assistant teacher Implementing cooperative learning activities Classroom teacher Using peer tutors Classroom teacher

Peer involvement	Taking the initiative to play with Mitch during recess Peers Volunteering to braille music sheets and practice during recess to increase Mitch's participation Peers Shifting the quality of interactions with Mitch from assistive to social Peers, teacher
Physical environment	Putting braille signs in the hallways, on doors, and in bathrooms Principal Helping Mitch gather books and papers at the beginning of a lesson Peers Changing the seats of all students to promote interaction and participation Classroom teacher
Problem-solving skills	"Desensitizing" Mitch's fear of the hallway bells Peers Identifying problems immediately and acting quickly Classroom teacher
Role release and flexibility	Assistant teacher and classroom teacher changing roles as needed Classroom and assistant teachers Increasing peer interaction by reducing the physical proximity of adults Assistant teacher
Social expectations	Using age-appropriate activities and materials Classroom and assistant teachers Helping Mitch learn how to talk about his feelings instead of crying Peers
Students' respect	Accepting Mitch's "weird" behavior Peers Peers noting Mitch's need for privacy during lunch Peers
Support services	Providing O&M and Braille instruction before school Instructors

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DEAF CHILDREN'S KNOWLEDGE OF INTERNAL HUMAN ANATOMY

The purpose of this study was to investigate ***deaf*** children's knowledge of internal human anatomy. A static group comparison design was used to gather data from 80 ***deaf*** children and 190 hearing children who attended either a local public school for the ***deaf*** and the ***blind***, or the regular public schools. Children were assigned to three groups according to age: 5-7 years, 8-11 years, and 12-15 years. Differences in ***deaf*** and hearing children's scores on the Draw-A-Person Test of general abilities were not statistically significant. Children's knowledge of internal body parts was assessed using a projective drawing test. Results indicated that (a) ***deaf*** children in successively older age groups knew more internal body parts than the younger subjects, and (b) ***deaf*** children in all three age groups knew significantly less about internal body parts than subjects in their normally hearing cohort.

The purpose of this study was to investigate ***deaf*** children's knowledge of internal human anatomy. Reports of recent health education task forces have singled out the nation's schools as essential for teaching school-age children and youths about factors that will influence their health (Cornell, Turner, & Mason, 1985; Iverson & Kolbe, 1983). Children's understanding about basic human anatomy is prerequisite to their understanding of more complex health education topics. Deficits in knowledge of internal anatomy also hamper children's ability to under stand maturational changes in their bodies.

A number of previous investigations have gathered information about children's understanding of internal anatomy (Gellert, 1962; Porter, 1974), but only one study (Gibbons, 1985) included ***deaf*** children. Reviews of related literature in health education usually focused on communication problems inherent in the relationship between ***deaf*** patients and their physicians (DiPietro, Knight, & Sams, 1981; Schein & Delk, 1980) or the need for improved sex education (Shaul, 1981; Tripp & Kahn, 1986). One exception was a study of health knowledge, attitudes, and practices of an adult ***deaf*** population (Lass, Franklin, Bertrand, & Baker, 1978). Results indicated that many of the study subjects did not understand common medical terminology, such as "nausea" and "allergy," and suggested that ***deaf*** adults had received little health education as children.

Gibbons (1985), a nurse, initiated a study of ***deaf*** children's knowledge of internal body parts after encountering difficulty with preoperative teaching with a young ***deaf*** girl who was hospitalized for surgery. Gibbons found that the ***deaf*** girl seemed to know far less about what was inside her body that her nondeaf peers

Gibbons then administered the Inside of-the-Body Test (IBT) and the Goodenough-Harris Draw-A-Person Test of general cognitive abilities to 10 ***deaf*** and 10 hearing children aged 8-10 years. Consistent with the methods used in other studies of children's knowledge of internal anatomy (Gellert, 1962; Porter, 1974), Gibbons used a projective drawing method to gather data about children's knowledge of internal body parts. Because knowledge of internal body parts is considered a function of cognitive development, most previous investigations also included some measure of cognitive functioning. Gibbons (1985) found that hearing children in her study named significantly more internal body parts than did ***deaf*** children. The total number of internal body parts named by the hearing children was 84, compared with 27 named by the ***deaf*** children. The ***deaf*** children also scored lower on the Goodenough-Harris Draw-A-Person Test. Therefore, Gibbons wrote that differences in IBT scores may have been confounded by the differences in general abilities between the groups.

Generalizability of Gibbons's (1985) study results was limited by the small sample size, use of private school populations, the narrow range of subjects" ages, and differences in scores of general ability across groups. The study reported in this paper modified and extended Gibbons's (1985) work by soliciting a larger sample of ***deaf*** and non deaf children from public schools, including a wider age range, and established comparability of general abilities across groups. The specific research questions were (a) What knowledge do ***deaf*** children have about internal human anatomy at different ages? and (b) How do ***deaf*** children compare to nondeaf (hearing children) in their knowledge of internal human anatomy?

METHOD

Subjects

A static group comparison design was used to gather data from a sample of 80 ***deaf*** children and 190 hearing children, aged 5-15 years, who attended either a local public school for the ***deaf*** and ***blind,*** or the regular public schools (see Table 1). Children with uncorrected vision problems, or known emotional or physical disabilities (other than hearing impairment) were excluded from the study. There was no health education program in the curriculum at the school for the ***deaf*** and ***blind,*** although there was an active physical education program that focused on sports and exercise. In addition, the nurse who was director of the school infirmary had conducted a few classes on reproductive anatomy after school for some of the adolescent ***deaf*** girls. The public school children participated in physical education classes from grade school forward. In sixth grade, the public school students' required health class included a semester devoted to anatomy and physiology. We collected data from the public school students in the first 6 weeks of their health class.

Children were gouped to reflect Piaget’s (Piaget & Inhelder, 1958) stages of cognitive development:

- Intuitive stage: age 2 or 3 until 7 or 8 years
- Concrete operations stage: age 7 or 8 until 11 or 12 years
- Formal operations stage: age 11 or 12 and older

Although Piaget's stages reflect overlapping ages, which account for transitional phases, the children in this study were assigned to three discrete age groups for comparison purposes. The youngest children were attending first grade, and the oldest were in junior high. Group I children were aged 5-7 years, Group II were aged 8-11 years, and Group III were aged 12-15 years. No tests were administered to determine individual children's actual stage of cognitive development due to limitations in the classroom time made available to the researchers. However, the literature commonly draws a correlation between chronological age and presumed stage of cognitive development.

Permission was obtained from school administrators, classroom teachers, and parents before children were invited to participate in the study. Of the public school (nondeaf) children whose parents gave permission, only 1 adolescent declined participation in the study. Between 1 and 3 hearing children in each group failed to return parental permission slips by the date of data collection. A similar number of ***deaf*** children aged 5-7 and aged 8-10 did not have parental permission slips by the day of data collection. Children without permission slips were allowed to do the drawings if they wished, but their drawings were neither collected nor included in data analysis. Approximately 7 ***deaf*** adolescents declined to participate in the study at any time with "no hard feelings." Children who consented to participate were tested as a group during regular class time. The researchers themselves administered the tests to ***deaf*** and hearing students using standardized test instructions. The teachers for the ***deaf*** children assisted by interpreting the researchers' verbal instructions into sign language.

Instruments

Each child completed (a) the Draw-A-Person Test (OAP) (Naglieri, 1988) to obtain data about general abilities, and (b) a projective drawing test to gather data about knowledge of internal body parts. Because many of the leading causes of hearing impairment (prematurity, meningitis, maternal rubella) also cause cognitive disabilities, it was important to address the potential confounding effects of differences in general abilities on children's knowledge of internal body parts.

The Draw-A-Person Test. The OAP was administered by asking children to draw a picture of a man, a picture of a woman, and a self-portrait (Naglieri, 1988). The OAP focuses on children's accuracy of observation and on the development of conceptual thinking. The OAP was appropriate for use in this study because of its nonverbal and nonacademic content, well-established reliability and validity, straightforward scoring procedure, and successful use in previous studies with ***deaf*** individuals (Gibbons, 1985; Naglieri, 1988). The drawings were scored against standardized criteria by raters who were research assistants. The raters were uninformed about the purpose of the study, and did not know whether the drawings they were scoring had been drawn by ***deaf*** or hearing children. Before beginning to score drawings for the study, raters were trained to interrater and intrarater reliabilities of at least .90 by the researchers. To monitor continuing consistency in scoring, 69 drawings were randomly selected throughout data collection to calculate interrater reliabilities. Interrater reliabilities remained at .94, and intrarater reliabilities were .95. In this study, Cronbach's alphas for the OAP ranged from .72 to .89, indicating satisfactory reliability (Nunnally, 1978). Although the ***deaf*** children's OAP scores were slightly lower than the nondeaf children's DAP scores in each age group, the difference was not statistically significant, X[sup2](1, n = 270) = 1.85, p<.17 (see Table 2).

The Inside-of-the-Body Test. The researchers administered the IBT by giving each child a prepared outline of the anterior view of the body and asking the child to draw in and label internal body parts (Gibbons, 1985; Porter, 1974). Test instructions included telling both ***deaf*** and hearing children that they could ask for assistance with spelling when they began to label the body parts. Children were assisted only with spelling the names of parts they had drawn, and were not prompted in their drawings. Children were given credit for either spoken or sign-language names for internal body parts.

Internal body parts were defined as parts of the physical self that are located beneath the skin, and are not visible under ordinary circumstances. Initial scoring was accomplished by calculating simple frequencies of the named internal body parts. However, the children had 105 labels for internal body parts, making data interpretation unwieldy, with many redundant categories. Coding categories were collapsed to accommodate synonymous labels, and to combine the internal body parts into logical categories. For example, separate categories for biceps, deltoid, pectoralis major, leg muscles, toe muscles, triceps, thigh muscles, and hip muscles were collapsed into a single coding category named "muscles." The final coding system included 25 coding categories (available from the authors upon request).

The stability of the data obtained from the IBT drawings was assessed by retesting a subs ample of 37 children drawn from both groups within 4 weeks of original data collection. The test-reliability correlation of 0.70 indicated satisfactory stability over time for a new measure (Nunnally, 1978). Interrater reliability, intrarater reliability, and interrater-intrarater agreement were established at over 90% at the beginning, midpoint, and end of the scoring period. The projective drawing had face validity. Construct validity was partially supported based on the assumption that the drawings were representative of children's actual knowledge of internal body parts.

RESULTS

An analysis of variance (ANOVA) was used to test for differences in IBT scores by (a) hearing status: ***deaf*** versus nondeaf children, (b) age groups: 5-7 years versus 8-11 years versus 12-15 years, (c) gender: boys versus girls, and (d) interaction between hearing status, age, and gender on IBT scores.

Results indicated that ***deaf*** children in successively older age groups had more information about internal anatomy than did younger subjects (Table 3). However, ***deaf*** children in all three age groups knew far less about internal body parts than their nondeaf cohorts (Figure 1). Differences in boys' and girls' IBT scores were not statistically significant, and there were no interaction effects between hearing status, age, and gender for either the DAP or IBT scores.

Calculation of the percentage of children in each group who named each body part was used to identify particular areas of children's strengths and limitations in knowledge of internal anatomy. Overall, the ***deaf*** children seemed most familiar with the heart, bones, and brain, and usually did not indicate knowledge of internal organs in the respiratory, gastrointestinal, reproductive, and immune systems, or skeletal support structures such as muscles, tendons, or cartilage.

Many of the 5-7 year-old ***deaf*** children (Group I) drew in the heart and arm or leg bones, and a few included blood vessels and one gastrointestinal organ, such as intestines. ***Deaf*** children aged 8-11 years (Group II) often depicted the added to their drawings the brain, blood vessels, hand and foot bones, and muscles. ***Deaf*** children in the oldest group (Group III) had more information about their body interiors than the younger groups. The majority of the oldest ***deaf*** children named the heart and long bones, and a substantial minority also included the brain, blood vessels, lungs, stomach, throat, and some internal abdominal organs, such as liver and kidneys.

A two-group, three-factor ANOVA (Hearing Status x Age x Gender) for the IBT drawings revealed statistically significant differences between groups, F(I) = 90.94, p<.O01 (Table 4), in the mean number of body parts named at each age group. Particularly striking is the fact that the mean number of body parts named by ***deaf*** adolescents aged 12-15 was lower than the mean number of body parts named by nondeaf children aged 5-7.

DISCUSSION

Results of this study indicated that ***deaf*** children knew very little about basic internal human anatomy, and lagged far behind their nondeaf peers in this information. The differences in ***deaf*** and hearing children's knowledge of internal body parts could not be attributed to differences in general abilities because their scores on the DAP were not statistically significant. The most obvious alternative explanation for the differences in knowledge of internal body parts is that ***deaf*** children receive less information than hearing children about internal anatomy.

A great many changes have occurred in recent years with legislation mandating education of ***deaf*** children in the least restrictive environments, and confirming the rights of handicapped children to an education equal to that of able-bodied public school children. Nevertheless, many communication barriers remain which restrict ***deaf*** children's access to health-related information that is more easily available to normally hearing children.

Potential sources of information about human anatomy might be conversations between parents and health care providers or educational television programs about physical health. For example, the ***deaf*** child cannot overhear conversations between parents and pediatricians about the child's illnesses, listen to family discussion about Uncle Harry's heart, or learn about the functions of the eye through educational television programs.

Older hearing children usually have classes in basic anatomy, physiology, and health education as part of the regular curricula in the public schools. Health education is often absent from the curricula for ***deaf*** children. A recent unpublished survey of 28 American schools for handicapped children Jones & Matte, 1987) indicated that fewer than half of the school health centers surveyed conducted any primary prevention programs with health education components. Rather, the health centers focused on secondary and tertiary prevention; that is, the health centers maintained information on children's height, weight, and immunizations, and provided episodic care for such problems as scraped knees or earaches. School nurses usually have only basic sign language skills, so they cannot effectively utilize their contacts with ***deaf*** children for even informal health education. There is some slight suggestion in the data that health education could be effective in improving ***deaf*** children's knowledge of internal anatomy. We noted that a higher percentage of ***deaf*** adolescent girls (14%) named female reproductive organs in their drawings than nondeaf adolescent girls (6%). ***Deaf*** adolescent girls were the only ones among the ***deaf*** children who were known to have received information about internal anatomy in a formal setting (the school nurse had conducted after school classes for the ***deaf*** adolescent girls about female reproductive anatomy and physiology the previous year). The higher percentage of older ***deaf*** girls versus older hearing girls who named female reproductive organs in their drawings is probably a reflection of what they learned in the classes conducted by the school nurse. Thus, ***deaf*** children have a potential to learn if given the information.

An understanding of basic human anatomy is the essential foundation for more sophisticated health education and improved health of all citizens. Without some background in basic anatomy and physiology, it is difficult for children or adults to integrate health teachings into their behavior (Vessey, 1988).

In conclusion, results from this study may be helpful to educators and nurses in schools for handicapped children, and in schools where handicapped children are mainstreamed, to recognize the need to develop beginning level classes in human anatomy for ***deaf*** children. Additional research about effective teaching methods would be particularly useful in eliminating differences in ***deaf*** and nondeaf children's knowledge of internal human anatomy.

TABLE 1
MEAN AGES OF DEAF AND NONDEAF CHILDREN BY SEX AND AGE GROUP

		Deaf		Nondeaf		
Age group		Girls	Boys	Girls	Boys	Total n
5-7 years	M	6-6	6-4	6-11	6-5	
	SD	9.26 [a]	9.67	7.81	7.07	
	n	6	12	21	22	61

8-11 years	M	9-3	9-11	10-1	9-10	
	SD	11.54	12.77	12.37	10.71	
	n	13	26	53	39	131
12-15 years	M	13 -2	13-7	11-11	12-9	
	SD	16.32	15.05	3.96	9.88	
	n	13	10	31	24	78
Total	n	32	48	105	85	270

[a] SDs are given in months.

TABLE 2
DRAW A PERSON SCORES (TOTAL STANDARD) BY AGE GROUP AND STATUS

Age	Hearing Status	Mean	SD
5-7 years	Deaf	102.17	14.53
	Hearing	104.81	18.01
8-11 years	Deaf	97.13	18.27
	Hearing	101. 73	12.23
12-15 years	Deaf	98.91	16.42
	Hearing	102.24	13.89

TABLE 3
COMPARISON OF PERCENTAGE OF DEAF AND NONDEAF CHILDREN IN THREE AGE GROUPS WHO NAMED SPECIFIC INTERNAL BODY PARTS

Age groups

	5-7 years		8-11 years		12-15 years	
Body part	Deaf	Nondeaf	Deaf	Nondeaf	Deaf	Nondeaf
Heart	39	81	82	91	87	95
Blood vessels	11	65	26	57	43	33
Brain	6	63	41	70	48	58
Bones						
Arm and leg	33	60	72	76	61	82
Head and body	11	28	31	67	13	85
Hands and feet	0	0	23	36	17	55
Lungs	0	37	8	45	26	47
Stomach	6	37	23	34	17	35
Muscles	0	30	23	34	17	35
Other GI organs	22	26	8	36	9	38
Throat	0	0	26	26	22	18
Internal Abd organs	0	17	0	40	30	51
Cartilage/tendons	0	0	0	6	0	17
Fat	0	0	0	0	0	4
Joints/marrow	6	0	4	10	5	13
Glands	0	6	0	3	0	6
Cells	0	0	3	1	0	6
Female reproductive	0	0	0	2	14	6
Male reproductive	0	0	0	0	0	2
Eardrum	0	0	0	3	0	4
Nerve	0	0	0	2	0	0
Mucus	0	0	0	0	0	2
External parts	11	0	3	1	0	4

TABLE 4
ANALYSIS OF VARIANCE ON IBT SCORES BY AGE, GENDER, AND HEARING STATUS

Source	Df	MS	F
Main Effect			
Age	2	127.68	24.40[**]
Gender	1	8.98	1.72
Hearing status	1	475.71	90.94[**]
Interactions			
Age x Gender	2	2.64	0.50
Age x Hearing	2	3.27	0.62
Gender x Hearing	1	0.01	0.00

[**] p<.001.

GRAPH: Figure 1. Mean number of internal body parts named by deaf and nondeaf children in three age groups.

Authors' Notes

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Abstract: This report identifies disparities in the proportions of vocational rehabilitation (VR) cases closed into competitive jobs (Status 26) based on type of hearing loss (i.e., deaf, late-deafened, and hard-of-hearing). Case records obtained from the RSA-9l1 database for fiscal year 1997 were evaluated. A series of chi-square tests and logistic regression analyses were utilized to investigate potential relationships. Results indicate that a significantly greater proportion of VR consumers who are deaf achieve competitive jobs than of consumers who are late-deafened and hard-of-hearing. A significantly lower proportion of VR services significantly associated with competitive jobs (i.e., college or university training, business and vocational training, on-the-job training, and job placement) were provided to consumers who were late-deafened and hard-of-hearing. Results are presented for work status at closure (i.e., competitive jobs vs. noncompetitive jobs), and the implications of findings for service and research are discussed. [ABSTRACT FROM AUTHOR]
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DISPARITIES IN JOB PLACEMENT OUTCOMES AMONG *DEAF*, LATE-DEAFENED, AND HARD-OF-HEARING CONSUMERS

This report identifies disparities in the proportions of vocational rehabilitation (VR) cases closed into competitive jobs (Status 26) based on type of hearing loss (i.e., ***deaf***, late-deafened, and hard-of-hearing). Case records obtained from the RSA-911 database for fiscal year 1997 were evaluated. A series of chi-square tests and logistic regression analyses were utilized to investigate potential relationships. Results indicate that a significantly greater proportion of VR consumers who are ***deaf*** achieve competitive jobs than of consumers who are late-deafened and hard-of-hearing. A significantly lower proportion of VR services significantly associated with competitive jobs (i.e., college or university training, business and vocational training, on-the-job training, and job placement) were provided to consumers who were late-deafened and hard-of-hearing. Results are presented for work status at closure (i.e., competitive jobs vs. noncompetitive jobs), and the implications of findings for service and research are discussed.

Current legislative priorities impacting on vocational rehabilitation (VR) programs place increased emphasis on achieving high-quality employment outcomes. Provisions contained in the Employment and Literacy Enhancement Act of 1997 (H.R. 1385) and the Rehabilitation Amendments of 1998 are evidence of this increased emphasis on high-quality employment outcomes. Competitive jobs, which comprise one high-quality employment outcome, allow VR consumers to acquire transferrable skills as well as to earn higher wages. For example, the level of income (i.e., weekly earnings) for VR consumers who achieve competitive jobs is nearly 10 times that for consumers who achieve noncompetitive jobs (i.e., noncompetitive work statuses; Menz, 1997).

It is estimated that between 21 and 28 million Americans have some type of hearing loss (Bureau of the Census, 1995). Degree and type of loss vary greatly. For example, individuals whose hearing loss is of such severity that they must depend primarily on visual communication such as writing, text reading (i.e., computer-aided real-time translation), speech reading, sign language (i.e., American Sign Language), and sign language interpreting are identified as deaf(Rehabilitation Services Administration Manual, 1995). Persons who become ***deaf*** after speech and language development are identified as late-deafened, while persons who are hard-of-hearing may understand conversational speech with or without amplification and are not primarily dependent on visual communication (Rehabilitation Services Administration Manual, 1995).

Studies have investigated the impact of VR services (i.e., the presence or absence of such services) on closure success for persons with hearing loss (Moore, in press-a) and level of income (Moore, in press-b). For example, Moore (in press-a) reported that consumers who were ***deaf*** and hard-of-hearing who were provided with a range of VR services, which included assessment, counseling, restoration, and job placement, were significantly more likely to achieve closure success than those who were not provided with such services (Status 26). Moore (in press-b) reported that those consumers who were ***deaf*** who were provided with job placement achieved higher levels of income than those who did not. However, relatively little current applied empirical research has investigated the relationship between VR services and work status at closure (i.e., competitive jobs vs. noncompetitive jobs) based on type of hearing loss (i.e., ***deaf***, late-deafened, and hard-of-hearing). As services are a function of need, results from the current study could provide data to identify, plan, and evaluate a more effective service delivery package for consumers who are ***deaf***, late-deafened, and hard-of-hearing.

Last year, the Rehabilitation Services Administration (2000), concerned about a steady decline between 1989 and 1998 in the number of "successfully rehabilitated" consumers with hearing loss, encouraged state VR agencies to examine their state RSA-911 databases to assess service delivery patterns. Findings from the current "snapshot" study provide a national benchmark that state VR agencies can use to compare rates at which consumers who are ***deaf***, late-deafened, and hard-of-hearing achieve competitive jobs, and to compare rates at which these target groups are provided with specific types of VR services. The current study also presents focal points that may assist these agencies, examining their own statewide RSA-911 databases and conducting case audits, to improve services to these consumer target groups. The following research questions were addressed:

1. Which consumer target group or groups (i.e., ***deaf***, late-deafened, or hard-of-hearing) is more likely to achieve competitive jobs?

2. Are assessment, restoration, college/ university training, business/vocational training, adjustment, on-the-job-training, counseling, job-finding services, job placement, transportation, and maintenance associated with achievement of competitive jobs?

3. Which consumer target group(s) received a higher proportion of selected VR services?

METHOD

Data Collection

This study utilized data obtained from individual client closure reports stored on RSA-911 national data tape, which was provided by the Rehabilitation Services Administration. The RSA-911 data tape was designed to maintain consumer information (i.e., sociodemographic characteristics, VR services received, and outcomes achieved). The federal-state VR program has developed a national standard for consumer outcome that includes a Status 26 or "rehabilitated" closure category (Rehabilitation Services

Administration Manual, 1995). Closure Status 26 indicates that a client has been suitably employed for a minimum of 90 days. Consumers who are closed "rehabilitated" (Status 26) are further coded for one of six specific work-status-at-closure categories: competitive employment, extended employment, ,elf-employment, state-agency-managed business enterprises, homemaker, and unpaid family worker. Because this study sought to evaluate consumers on the basis of whether they achieved competitive jobs or not, cases that were not closed into this category were collapsed into the noncompetitive jobs category. Consequently, there were two states of the dependent variable: competitive jobs and noncompetitive jobs.

Population

In order to derive data specific to the three target groups of interest, all VR consumers who were identified as ***deaf*** (major disability codes 231-249), late-deafened (major disability codes 253-259), and hard-of-hearing (major disability codes 261-289) were included in this study. The population for this study was thus all 15,248 *deaf*, late-deafened, and hard-of-hearing consumers closed into Status 26 by the VR system nationally during fiscal year 1997 (October 1, 1996 through September 30, 1997). Of these 15,248 consumers with hearing loss, 5,543 (36%) were ***deaf***, 592 (4%) were late-deafened, and 9,113 (60%) were hard-of-hearing. The relatively small percentage of participants who are late-deafened could be attributed to the fact that many persons who become ***deaf*** later in life do not know about vocational rehabilitation programs (Glass & Elliot, 1993). On the other hand, many consumers who are ***deaf*** or hard-of-hearing lose their hearing at earlier ages and receive special education and transition services from school systems that are aware of the purpose of VR programs.

Data Analysis

Two different tests of statistical significance were utilized in the current study: chi-square tests and logistic regression analyses. Chi-square tests are appropriate for evaluating dichotomous independent and dependent variables (Huck & Cormier, 1996). Based upon Cohen and Cohen's (1983) approach, logistic regression is the most appropriate technique for evaluating the linear relationship between two or more predictor variables (i.e., VR services) and a dichotomous dependent variable (i.e., work status at closure).

First, chi-square analyses were conducted for type of hearing loss (i.e., ***deaf***, late-deafened, and hard-of-hearing) and work status at closure (i.e., competitive jobs or non-competitive jobs). Since this analysis involved three comparison groups (i.e., ***deaf***, late-deafened, and hard-of-hearing), a statistically significant outcome does not give insight as to which populations differ from one another. To gain such insights, the researcher conducted post hoc pairwise comparisons (2 x 2 chi-square tests) between ***deaf*** and late-deafened; ***deaf*** and hard-of-hearing; and late-deafened and hard-of-hearing. Whenever two or more separate chi-square tests are conducted within a post hoc investigation, each using the same level of significance as that used in the initial chi-square tests, the chances of a Type I error will exceed the nominal level of significance (Huck & Cormier, 1 996)--that is, the chances of indicating a significant relationship when there is in fact no significant relationship (Saxon, Alston, & Hobert, 1994). Thus, to guard against possible Type I errors, the researcher implemented the Bonferroni Technique; alpha levels were set at .003 (i.e., .01/3) to adjust for Type I error.

Second, logistic regression analyses evaluated the linear relationship between VR services and work status at closure. Third, chi-square tests evaluated the proportions of significant VR services received by consumers who were ***deaf***, late-deafened, and hard-of-hearing. Last, the relationship between type of hearing loss and work status at closure was evaluated for those consumers who had received those VR services that were found to be significantly associated with work status at closure. Those consumers who had not received these selected VR services were eliminated from the sample. Thus, in this study the researcher was able to examine two-way interactions among type of hearing loss, work status at closure, and selected VR services (using the chi-square test) by evaluating only those consumers who had received those selected VR services. The chi-square and logistic regression procedures of the Statistical Package for the Social Sciences (SPSS, 1989) were used in these calculations.

RESULTS

For fiscal year 1997 there were 5,543 (36%) ***deaf***, 592 (4%) late-deafened, and 9,113 (60%) hard-of-hearing VR consumers. Female participants represented 51 % of the total population served. The population consisted of an overwhelming majority of Caucasians (85%). African Americans, Native Americans, and Asian Americans accounted for 12%, 1 %, and 2% of the population, respectively. A small percentage of the population received VR-sponsored support for college or university training, business and vocational training, adjustment training, on-the-job training, transportation, and maintenance. Assessment, restoration, counseling, job-finding services, and job placement were received by 89%, 59%, 85%, 40%, and 35% respectively.

Target Groups and Competitive Jobs

An analysis of the available data revealed that 13,394 of the 15,248 participants (88%) were closed into competitive jobs following VR intervention. First, 2 x 2 cross-tabulations for each hearing-loss group (i.e., ***deaf***, late-deafened, and hard-of-hearing) and work status at closure (i.e., competitive job or noncompetitive job) were examined visually to determine the relationship (if any) among each of the variables. Cross-tabulations revealed differences among the percentages of consumers who were ***deaf*** (92%), late-deafened (82%), and hard-of-hearing (86%) closed into competitive jobs.

Chi-square analysis revealed that type of hearing loss was significantly related to work status at closure, chi[sup 2](2, N = 15,248) = 129.768, P < .01. Pairwise comparisons were nonsignificant for late-deafened versus hard-of-hearing, chi[sup 2](1, N = 9,705) = 5.187, P > .003, but significant for ***deaf*** versus late-deafened, chi[sup 2](1, N = 6,135) = 55.652, P < .003, and for ***deaf*** versus hard-of-hearing, chi [sup 2](1, N = 14,656) = 114.679, P < .003. That is, consumers who were ***deaf*** achieved competitive jobs at a significantly greater rates than consumers who were late-deafened and hard-of-hearing.

VR Services and Competitive Jobs

Second, the distributions of VR services (i.e., assessment, restoration, college or university training, business and vocational training, adjustment, on-the-job-training, counseling, job-finding services, job placement, transportation, and maintenance) were examined. Ideally (for analytic purposes) those variables should have exhibited a 50-50 split or distribution. That is, half of the participants should have been provided with each service and the other half not. Although distributions of 80%-20% are appropriate for logistic regression analyses, variables with distributions more skewed than 80%-20% (e.g., 95%-5%) should be excluded from the procedure (Cohen & Cohen, 1983). No predictor variables were excluded based on this criterion.

Third, 2 x 2 cross-tabulations between each VR service and work status at closure were examined visually to determine the relationship (if any) among each of the variables. For example, if the percentage of consumers who received job placement services and achieved competitive jobs was higher than the percentage of those who did not receive this service and achieved competitive jobs, the job placement service variable would be retained as a variable that might shed light on work status at closure. As a general rule, differences of more than 5% on the independent variable between states of the dependent variable were considered for further analyses (Bullis, Davis, Bull, & Johnson, 1995). Five variables were dropped at this point because they did not meet these criteria: assessment, restoration, adjustment, counseling, and transportation.

Fourth, phi correlations among the remaining six VR services (i.e., college or university training, business and vocational training, on-the-job-training, job-finding services, job placement, and maintenance) were calculated, as were correlations between the six VR services and work status at closure. Correlations among these variables ranged from .02 to .88. The correlation coefficient for job placement and job-finding services (r = .88) indicated that multicollinearity was an issue. Therefore, the job-finding services variable was dropped from further analyses. Correlations among the remaining predictor variables, ranging from .02 to .32, were sufficiently low to conclude that multicollinearity was no longer an issue. Correlations among the predictor variables and the criterion variable ranged from .06 to. 16.

Fifth, a logistic regression analysis investigated the linear relationship between college or university training, business and vocational training, on-the-job training, job placement, maintenance, and work status at closure. Of the five VR service variables entered into the logistic regression, college or university training (p < .01, r[sup 2] = .01), business and vocational training (p < .01, r[sup 2] = .02), on-the-job training (p < .01, r[sup 2] = .02), and job placement (p < .01, r[sup 2] = .03) were significant predictors of competitive jobs (see Table 1).

Target Groups and Selected VR Services

Sixth, chi-square analyses were run between type of hearing loss (i.e., ***deaf***, late-deafened, and hard of hearing) and the selected VR services (i.e., college or university training, business and vocational training, on-the-job training, and job placement). Chi-square analysis revealed that type of hearing loss was significantly related to college or university training, chi[sup 2](2, N = 15,248) = 276.217, P < .01 (see Table 2). Post hoc pairwise comparisons were nonsignificant for late-deafened versus hard-of-hearing, chi[sup 2](1, N = 9,705) = 4.675, P > .003, but significant for ***deaf*** versus late-deafened, chi[sup 2](1, N = 6,135) = 50.391, P < .003, and ***deaf*** versus hard-of-hearing, chi[sup 2](1, N = 14,656) = 252.966, P < .003. That is, consumers who were ***deaf*** were provided with college or university training at a significantly higher rate than consumers who were late-deafened and hard-of-hearing.

Chi-square analysis revealed that type of hearing loss was significantly related to business and vocational training, chi[sup 2](2, N = 15,248) = 100.092, P < .01 (see Table 2). Pairwise comparisons were again nonsignificant for late-deafened versus hard-of-hearing, chi[sup 2](1, N = 9,705) = .040, P > .003, but significant for ***deaf*** versus late-deafened, chi[sup 2](1, N = 6,135) = 12.807, P < .003, and ***deaf*** versus hard-of-hearing, chi[sup 2](1, N = 14,656) = 96.349, p < .003. Once again, consumers who were ***deaf*** were provided with a significantly higher proportion of business and vocational training when compared to consumers who were late-deafened and hard-of-hearing.

Chi-square tests indicated that type of hearing loss was significantly associated with on-the-job training, chi [sup 2](2, N = 15,248) = 153.955, P < .01 (see Table 2). Pairwise comparisons were nonsignificant for late-deafened versus hard-of-hearing, chi [sup 2](1, N = 9,705) = .001, p > .003, but significant for ***deaf*** versus late-deafened, chi[sup 2](1, N = 6,135) = 16.922, P < .003, and ***deaf*** versus hard-of-hearing, chi[sup 2](1, N = 14,656) = 149.030, P < .003. That is, consumers who were ***deaf*** were provided with significantly more on-the-job training than consumers who were late-deafened and hard-of-hearing.

Chi-square analysis revealed that type of hearing loss was also significantly associated with job placement chi[sup 2](2, N = 15,248) = 601.235, p < .01 (see Table 2). Post hoc analyses (pairwise comparisons) were once again nonsignificant for late-deafened versus hard-of-hard of hearing, chi [sup 2](1, N = 9,705) = 6.317, p > .003, but significant for ***deaf*** versus late-deafened, chi [sup 2](1, N = 6,135) = 124.710, p < .003, and ***deaf*** versus hard-of-hearing, chi [sup 2](1, N = 14,656) = 561.243, p < .003. As was the case with college or university training, business and vocational training, and on-the-job training, job placement was provided to a significantly higher proportion of consumers who were ***deaf*** than of consumers who were late-deafened and hard-of-hearing.

teacher preparation programs overemphasize speech and language development and might not provide adequate instruction in mathematics teaching methods. There is very little information concerning possible methods in teaching mathematics to ***deaf*** students, and there is a need for more research concerning ***deaf*** students' mathematics achievement.

Mathematics Vocabulary

The National Council of Teachers of Mathematics (NCTM) has published Curriculum and Evaluation Standards for School Mathematics (1989) which outlines necessary goals for maximum conceptual understanding of mathematics. One of the standards is "Mathematics as Communication." Within this standard al each grade level are suggestions for incorporating language into mathematics instruction. NCTM urges teachers to give students the opportunity to read, write, and discuss ideas so that the use of the language of mathematics becomes natural. These recommendations should be especially pertinent to ***deaf*** students, whose communication and language needs are different and sometimes greater than those of hearing students.

Given that reading and vocabulary in general are problematic for ***deaf*** students, mathematical reading and vocabulary might pose even greater difficulty for this population. Reading in mathematics makes special demands on any reader, ***deaf*** or hearing. There are "two languages of mathematics" (Shepherd, 1973), the technical vocabulary and the specialized symbols, both of which are necessary for success in reading in mathematics. Within these two languages of mathematics there are five levels of response: (a) letters, (b) words, (c) sentences, (d) paragraphs, and (e) discourse. In this model, reading proceeds from small units to larger units of complete discourse.

Lamb (1980) delineates potential problems in reading mathematics at the above word level into five categories. These categories include:

Words with More Than One Meaning: Words such as "square," which can mean "a geometric figure," "outdated," or "a mathematical operation (102)."

Words with Special Emphasis in Mathematics: Phrases such as "how many," "how many more," or "how many less" have special meaning in mathematics. Knowing the subtle emphasis of words such as these has important bearing on solving such mathematical problems.

Technical Vocabulary: Technical terminology in mathematics can present various problems. The word may be entirely new to the learner, who may have difficulty pronouncing the word or using word analysis skills to attempt to understand the word. Most likely, if the terminology is new to the learner, the concept might be new also. Many times technical words have no simple concrete referent. Some examples of words in this category are "sine," and "polynomial."

Varied Forms: Many basic words have several grammatical forms, for example, "multiply," "multiplier," "multiplicand," and "multiplication. " The student must know the fine distinctions in meaning among these words, in addition to differences in spelling and pronunciation.

Abbreviations and Special Symbols: Abbreviations are an additional form of a word (as in the category above), so there is yet another form to remember for the student. Symbols are sometimes unfamiliar in appearance, and often have no logical connection to the concept they represent. Also, certain abbreviations and symbols may have multiple meanings. For example, the two short parallel lines used to denote inches ("), are identical to quotation marks and "ditto" marks in English.

Given that ***deaf*** students have difficulties with reading and vocabulary, and given that the specific area of mathematics vocabulary presents unique problems to the general population, one might conclude that *deaf* students possibly do not comprehend mathematical vocabulary as well as they might. The following study examines ***deaf*** students' comprehension of mathematical vocabulary to see if there are problems similar to ;hose described by Lamb (1980).

Method

Subjects

Twenty-five ***deaf*** students enrolled in a state school for the ***deaf*** in the southwest were included in this study. All students were taking mathematics at the high school level, grades 9 through 12. Classes being taken included FOM (Fundamentals of Mathematics), Consumer Mathematics, Algebra, Algebra 11, and Geometry. Academically the students were in the top two ability groups as delineated by school placement. Only these two levels were chosen because lower achieving students were thought to have too much difficulty reading the test. Students in this study use American Sign Language, English-based sign language, or a mixture, as their primary mode of communication. Additionally they use fingerspelling, lipreading, gestures, and body language.

Materials

The test consisted of 50 multiple choice items, each with one correct answer and three distractors. There were five sections of the test, as described above: Words with more than one meaning, phrases with special meanings in mathematics, technical vocabulary, varied forms, and symbols. There were ten questions in each of the five sections. The vocabulary was taken from various middle school mathematics textbooks. Therefore, the vocabulary is judged to be on about the seventh or eighth grade level. The test was created by the third author of this paper, and copies can be obtained by writing: Charles E. Lamb, Oept. of C & I EDB 406, University of Texas at Austin, Austin, Texas 78712.

Design and Procedure

The vocabulary test was given during the students' regularly scheduled mathematics classes. The tests were given in a room of the school library, with between two and six students taking the test at one time. Students were orally informed as to the purpose of the test and its expected uses. They were also told that this test would have no effect on their grade in mathematics class. Permission forms were obtained from all the students involved, as well as from their parents/guardians.

Results

The tests were scored by percent correct overall, and percent correct according to category. Overall, the mean percentage of questions answered correctly was 46%. Average score by category is presented in Table 1.

Discussion

It is interesting to note that the students scored highest on the category of words with more than one meaning. Perhaps students felt more comfortable with these words having seen them in other situations, and were able to answer more of these kinds of questions correctly due to their word association skills. The category of mathematical symbols had the second highest score, perhaps because of the visual nature of symbols. Although symbols often do not have a logical visual connection to the concept they represent, students can easily grasp and remember the meanings of symbols since they are often unusual and look different than regular words. The scores decline in the section on words with special emphasis in mathematics. Words included in this category are often seen in everyday life but have distinct and often subtly different meanings in mathematics. It is possible that the students knew at most one meaning for these words, and scored poorly due to reliance on more general knowledge of the words. The category of varied forms also had low scores; it could be supposed that there might be an influence of sign language in this case. Often only one sign is used to represent several words that have varied forms, for example, the words multiply, multiplicand, multiplier, and multiplicative. There is no way, other than fingerspelling, to represent these words differently from one another. Proponents of various signed English sign languages that use signed suffixes for words might have created signs for these various forms of words, but in American Sign Language such words would be fingerspelled. It is possible that unless these different words are specifically taught, ***deaf*** students might group them together in the reaming process and use them interchangeably because of not knowing the separate meanings.

Unsurprisingly, the highest percentage of errors was found with respect to technical words used in mathematics. Many technical words are from the more advanced areas of mathematics, to which fewer of the students had been exposed. Also, technical words are often forgotten due to lack of everyday use. Perhaps certain technical words are harder to teach because they have no sign and must be fingerspelled. Fingerspelling a word might have an impact on whether the word is remembered later, that is, it might be harder to remember a word if it is fingerspelled rather than if it has a specific sign.

This study indicated that due to a weakness in the reading of mathematical vocabulary, much of what ***deaf*** students read about mathematics may not be understood. As with any area of reading and vocabulary, it could be inferred that ***deaf*** students might perform more poorly on a test of mathematical vocabulary than their hearing peers; further research would be beneficial. Granted, hearing students with reading problems might have similar scores as those stated here. This study in no way is meant to indicate an inability on the part of the ***deaf*** reamer. Rather, it is meant to indicate areas of learning in mathematics which may need more attention from *deaf* educators. It is proposed that there should be more emphasis on mathematical vocabulary in the mathematics classroom, as well as in the language arts classroom.

Recommendations

A suggested method to use with ***deaf*** students might be to teach mathematical concepts involving all areas of vocabulary comprehension. That is, teach the written word (along with the spelling), the symbol, provide examples, and involve the students in conceptually based activities. If the students use sign language, the proper sign for the concept as well as the correct fingerspelling should be taught in conjunction with the reading and writing of the vocabulary. The signs used and taught in mathematics should be conceptually based for maximum comprehension. The "invention" of signs should be avoided; the correct sign should be used or the term could be fingerspelled. A good resource for mathematical signs is Technical Signs Manual 3. Mathematics, (Caccamise, et al, 1982).

Language arts types of activities could be included in mathematics lessons. For example, when beginning the concept of multiplication, the written word "multiplication" should be provided (both alone and in context), and then the symbol for multiplication, "x," should be shown, and also the sign or signs. Examples of multiplication in written or manipulative form as well as activities for practice would be incorporated into the lesson. Writing activities might include keeping a mathematics journal or describing how to multiply to a friend. Paradis and Schleper (1990) describe a successful program of writing "learning logs" with ***deaf*** students in the mathematics classroom.

Also, manipulatives should be used whenever possible. Fridriksson and Stewart (1988) suggest a format working from the concrete to the abstract using manipulatives with ***deaf*** students. Additionally, cooperative learning and small group situations would provide necessary communication (as encouraged in the NCTM Standards) among students to reinforce the reamed vocabulary and mathematical concepts.

In conclusion, it is most important to remember that mathematics is not only numbers; reading, language, amd vocabulary are integral components in mathematics. Teachers aware of this will specifically teach their students to read and understand mathematical vocabulary in conjunction with mathematical concepts. If this is done, overall comprehension of mathematics will improve.

Table 1 Average Percent Correct According to Vocabulary Category

Category	Average % Correct (out of 100%)
I. More than one meaning	58
II. Special emphasis	42
III. Technical	38
IV. Varied forms	39
V. Symbols	53

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Subject(s): DEAF
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THE STRUCTURE OF ATTITUDES TOWARD PERSONS WHO ARE *DEAF:* EMOTIONS, VALUES, AND STEREOTYPES

ABSTRACT. The relative effects of affect, cognition, and stereotyping on attitudes toward persons who are ***deaf*** were studied. Respondents (N = 175) were initially asked to list terms or phrases that described (a) a typical person who is ***deaf***, (b) the feelings the respondent experienced when thinking of a typical person who is ***deaf***, and (c) beliefs about how a typical person who is ***deaf*** either facilitates or blocks cherished values held by the respondent. Then, each respondent evaluated as positive or negative each of the terms or phrases he or she wrote down. The relative effects of personality variables and structural variables on prejudicial attitudes were also assessed. Affect and past experience figured prominently in respondents' attitudes toward people who are ***deaf*** Explanations for these findings and the implications of these results for prejudice formation and reduction were explored, especially in light of the passage, implementation, and enforcement of the Americans with Disabilities Act.

THERE IS AN EXTENSIVE LITERATURE on the attitudes of people who can hear toward those who are ***deaf*** (for a review, see Shaver, Curtis, Jesunathadas, & Strong, 1987). What this literature suggests is that attitudes toward the *deaf*, like other intergroup attitudes, are complex (Messick & Mackie, 1989; Tajfel, 1982). According to the researcher's theoretical orientation, certain determinants of attitudes (e.g., affective, cognitive, behavioral intentions) would be emphasized over others. Recently, Zanna and his associates developed a theoretical approach to intergroup attitudes and a research strategy that address the comp lexities of the structure of intergroup attitudes (Esses, Haddock, & Zanna, 1993; Zanna, Haddock, & Esses, 1990; Zanna & Rempel, 1988). Their approach synthesizes the effects of values, stereotypes, and emotions in the formation of intergroup attitudes.

In the present study, I used Zanna and his associates' theoretical model and analytical approach to examine the influence of emotions, values, and stereotypes on the attitudes of people who can hear toward people who are ***deaf*** The study had two parts: (a) The relative effects of values, stereotypes, and affect on attitudes toward people who are ***deaf*** were tested and (b) the influence of individual-difference variables, specifically, measures of psychological insecurity and past experiences, were investigated.

Theoretical and Empirical Literature on the Structure of Intergroup Attitudes

Attitudes held by hearing people toward persons who are ***deaf*** refer to "an individual's disposition[s] to respond favorably or unfavorably" to those group members (Ajzen, 1989, p. 241). These attitudes or dispositions involve a hearing person's forming a summative evaluation of persons who are ***deaf*** based on their group membership. There is an extensive research literature on the multifaceted nature of intergroup attitudes (Eagly & Chaiken, 1993). One contemporary approach to the structure of intergroup attitudes recognizes their multifaceted character and attempts to integrate the influences of affect, values, and stereotypes on intergroup attitudes (Esses et al., 1993).

Affect, values, and stereotypes are central to an understanding of intergroup attitudes. Attitudes expressed toward any group--for example, by hearing people toward persons who are ***deaf***-entail some positive and negative feelings, some positive and negative stereotyping, and perceptions of the outgroup as potentially blocking or facilitating values. Attitudes are also influenced by personality and social-situation variables, such as positive contact with outgroup members (Tajfel, 1982).

Stereotypes and Attitudes

Recent social psychological research on attitudes has presented a sophisticated view of stereotyping. Stereotyping is a categorization process. A person using a stereotype can tell researchers what the "typical" person of some social group (say, persons who are ***deaf)*** may be like. But this "typical" person cannot describe all ***deaf*** people; rather, the respondent is describing a trait that is "somewhat" characteristic of ***deaf*** people. (Brown, 1986, p. 608; Linville, Salovey, & Fischer, 1986).

Values and Attitudes

Rokeach (1973, p. 5) defined a "value" as "an enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct or end-state of existence." Attitudes are predicated upon values; so, if a person expresses an attitude toward, for example, persons who are ***deaf***, the favorable or unfavorable expression depends upon a perception of whether ***deaf*** persons facilitate or block some cherished value(s) held by that person.

Affect and Attitudes

Emotions are a powerful source of attitudes. In a study of intergroup attitudes, Allport (1954) noted that prejudice is most often a negative feeling toward an out group member that resists change even in the face of new, contradictory information. Prejudice can, of course, involve positive evaluations as well. These positive feelings can represent prejudice if the feelings are rigidly held and are resistant to change in light of new, contradictory information. Emotions and ethnocentrism are related, in that a respondent tends to evaluate ingroup members positively and to feel less positively toward members of another social group (Kleinpenning & Hagendoom, 1993).

Individual Differences Versus Social Factors

Much has been written on the relationship between individual prejudice and expressing right-wing authoritarianism (for a review, see Christie, 1991). The theory is that psychological insecurity is related to distrust and rigid thinking about out group members. Allport (1954) and others have noted that attitudes can be shaped by psychological as well as social forces. Sherif, Harvey, White, Hood, and Sherif (1961), in their "Robbers' Cave Study," experimentally manipulated ethnocentrism, stereotypes, and perceived injustices among 11-year-old boys at summer camp. The levels of hostility and negative attitudes expressed by the groups of boys toward one another were controlled and changed by creating various social situations that were conducive to or inhibited cooperation. The quality of experiences and group interests are clearly related to intergroup attitudes (Bobo, 1988).

Method

Respondents

Undergraduate students (N = 175) at Utah State University volunteered to participate in this study, which was part of a larger project on intergroup attitudes conducted in 1994. Students were in a general education course, and their majors at the university were diverse (e.g., engineering, biology, agriculture, art, education, business, family and human development, and forestry).

Instruments

Feeling thermometer. Each respondent initially was asked to indicate his or her overall evaluation of a "typical person who is deaf' on a feeling thermometer ranging from 0 (extremely unfavorable) to 100 (extremely favorable). The thermometer, as in Campbell's (1971) strategy, was labeled every 10 degrees from the extremes with the adjectives very, quite, fairly, and slightly. The midpoint was labeled neither favorable nor unfavorable.

Stereotypes. Next, each respondent was instructed to "provide a description of typical members of [persons who are deaf]. Your description should consist of a list of characteristics or, if necessary, short phrases that you would use to describe typical members .... " (Esses et al., 1993). Then, each respondent was asked to evaluate each descriptor on a scale from -2 (very negative) to +2 (very, positive). Finally, each respondent indicated the percentage of persons who are deaf who possess each characteristic.

Emotions. Each respondent was provided with the following instructions:

Please provide a list of the feelings you experience when you think about typical members of [persons who are deaf]. Provide as many feelings or emotions as you believe are necessary to accurately convey your impression of the group and to describe members adequately.

Again, each respondent evaluated each feeling on a scale of -2 (very negative) to +2 (very positive). Then each respondent indicated the percentage of persons who are ***deaf*** who elicit each feeling expressed.

Values. Each respondent was asked to "indicate the values, customs, and traditions whose attainment is either facilitated or blocked by typical members of [persons who are ***deaf***]." Then, each respondent rated the degree to which the typical person who is ***deaf*** blocks or facilitates each expressed value. The range was -2 (blocks a lot) to +2 (facilitates a lot). Finally, each respondent assessed the percentage of persons who are ***deaf*** who block or facilitate each value mentioned.

For stereotypes, emotions, and values, a score was calculated to represent each dimension. Each valence score (values from -2 to +2) was multiplied by the corresponding percentage. The resulting values for each listed descriptor were summed. Then the sum was divided by the total number of descriptors listed. The process can be represented mathematically:

(P[sub ig] x V [sub ig])/n

Scores were calculated for stereotypes, emotions, and values.

Individual differences. Following Esses et al. (1993), I used the Right-Wing Authoritarianism Scale to measure individual differences. An abbreviated version of this scale, developed by Altemeyer (1988), was used. Ten items were selected. An example of the kind of items appearing in the scale was: "Obedience and respect for authority are the most important virtues children should learn." Each item had a corresponding response scale ranging from 1 (very strongly disagree) to 9 (very strongly agree). The alpha reliability coefficient for the scale was .91.

Past experiences. To assess the role of situational factors on intergroup attitudes, each respondent was asked two questions: (a) "Please describe the degree of contact/interactions you have had with persons who are ***deaf***" and (b) "If you have had any contact with persons who are ***deaf***, on the whole, how would you characterize these experiences?" The first question was measured on a scale of 1 (none at all) to 7 (quite a lot). The second question was measured on a scale of -2 (very negative) to +2 (very positive). The two scores were multiplied to obtain a score representing both degree and quality of past experiences.

Results

The mean attitude score for persons who are ***deaf*** was 81.11 (SD = 15.3). The most common descriptors for persons who are ***deaf*** were happy, alone, angry, end friendly. The descriptors for persons who are ***deaf*** varied widely but were generally positive.

A multiple-regression analysis with ***deaf*** persons as target-group members indicated that for attitudes toward persons who are ***deaf***, past experience and affect were statistically significantly related.

Discussion

The present results suggest that the structure of attitudes toward persons who are ***deaf*** are systematically different from the structure of attitudes toward persons with other disabilities, as described in the theoretical and empirical literature (Esses et al., 1993). For our respondents, attitudes toward persons who are ***deaf*** were shaped by affect and past experiences. In general, respondents' feelings toward persons who are ***deaf*** were positive. The positive cultural images of persons who are ***deaf*** (e.g., Hollywood films such as Children of a Lesser God or the recent selection of a ***deaf*** woman as Miss America) likely influenced respondents' attitudes, especially feelings. To the extent that interactions with persons who are ***deaf*** were relatively infrequent among the respondents, respondents' attitudes were shaped by affective elements of the cultural imagery. When respondents were asked to list characteristics of persons who were ***deaf***, the terms varied: happy, alone, angry, and friendly. None of those descriptors is threatening. Attitudes, then, may tend to be positive because persons who are ***deaf*** do not pose a political, social, or economic threat to nondeaf people.

Esses and colleagues (1993, p. 160) speculated that attitudes toward persons with disabilities would likely be influenced significantly by affective responses. They reasoned that respondents would be repulsed by disability and respond with "gut reactions." Interestingly, this is not the case with attitudes toward persons who are ***deaf*** Respondents seem to discriminate between groups of persons with disabilities and respond differently (Lane, 1993; Makas, 1994).

Past experience influences attitudes toward persons who are ***deaf*** Because intergroup interactions are so infrequent, the quality of experiences figures significantly.

Conclusion

In this study, I examined a theoretical framework developed by Zanna et a1. (1990) and applied it to specific intergroup attitudes. In a discussion of future research directions, Esses et a1. (1993, p. 160) queried "whether different findings are systematically obtained for different types of social groups." The results of this study suggest that the structure of intergroup attitudes toward persons who are ***deaf*** might well be different from what researchers would expect for persons with disabilities more generally.

Although the respondents' attitudes toward persons who are ***deaf*** were generally positive, these findings could be context specific. That is, persons who are ***deaf*** are not viewed as a political, social, and economic threat to nondeaf persons. What would happen to attitudes if political activity by people who are ***deaf*** became more prominent around, say, educational policies and practices?

Beyond the theoretical work examined here, there is also an applied component. If we want to modify attitudes toward persons who are ***deaf***, what would be the best avenue? Given the theoretical framework developed here and the empirical findings, the answer seems to be affective appeals and contact. But, as Tajfel (1982) noted, it is not contact, per se, but interactions that are varied, frequent, and diverse that make it difficult for individuals to maintain negative stereotypes.

However, there is irony here. It could well be that attitudes toward ***deaf*** persons are so positive precisely because there is little intergroup conflict. Harlan Lane (1993) noted that although persons who can hear typically do not harbor hostile attitudes toward those who can't, they do often express patronizing and paternalistic attitudes. With more contact and competition for resources, for example, in the educational arena (e.g., mainstrearning or college campuses), attitudes toward people who are ***deaf*** could become more negative. So, it becomes an open question whether varied, frequent, and diverse contact will necessarily lead to the development of positive attitudes, as Tajfel (1982) suggests.

I would like to thank Mark Zanna for sharing the instruments he and his colleagues developed to measure the structure of intergroup attitudes.

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Subject(s): PHYSICAL education & training; VISUALLY handicapped -- Training of Source: Review, Fall 99, Vol. 31 Issue 3, p129, 10p
Author(s): Lieberman, Lauren 1.; Houston-Wilson, Cathy
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Best Part

OVERCOMING THE BARRIERS TO INCLUDING STUDENTS WITH VISUAL IMPAIRMENTS AND DEAF-BLINDNESS IN PHYSICAL EDUCATION

Today more Americans are participating in physical activities than ever before. Activities like tae-bo, in-line skating, and martial arts have fostered participation by people of all skill levels and abilities. Physical activity is defined as "movement of the human body that results in the expenditure of energy at a level above the resting metabolic rate" (Anshel et al" 1991, p. 113). Benefits associated with involvement in physical activity include reduced risk of heart disease, diabetes, high blood pressure, high cholesterol levels, and decreased stress levels (Surgeon General, 1996). Furthermore, the social and psychological benefits of increased physical activity are tremendous. Many individuals involved in daily exercise report better ability to sleep, improved self-esteem, increased stamina, and decreased stress levels, attributes that lead them to have a better attitude about life (Martinsen & Stephens, 1994; McAuley, 1994). Research also indicates that when students are involved in daily physical activity, their inappropriate behaviors as well as their self-injurious or self-destructive behaviors decrease (Craney, 1994).

Unfortunately, students who are blind or ***deaf***-blind are not afforded the same opportunities to participate in regular physical activity and do not attain the same psychological, social, and physical benefits as their sighted peers (Sherrill, 1998). That situation occurs in part because having to devote more time to academic subjects than their sighted peers hinders their ability to engage in leisure and physical activity (Sherrill, 1998). Psychologically and socially, people who are more sedentary tend to have negative affect, anxiety, depression, low self-esteem, low confidence, and poor self-efficacy (Morgan, 1994). Physically, individuals who are blind and ***deaf***-blind tend to possess higher levels of body fat and lower levels of cardiovascular endurance, muscular strength, and muscular endurance than their sighted peers (Jankowski & Evans, 1991; Lieberman & Carron, 1998; Skaggs & Hopper, 1996; Winnick & Short, 1985). Winnick (1985) has also determined that students who are blind are less adept at activities such as throwing, catching, balancing, striking, and body and spatial awareness. Those various delays are attributed not to genetic limitations of performance but rather to the overprotective and discouraging attitudes of parents or teachers who do not allow individuals who have visual impairments or are ***deaf***-blind to participate in physical activity (Nixon, 1988; Winnick, 1985).

These deficits in physical and motor fitness are especially alarming because in almost every daily activity individuals who are blind expend more energy than sighted individuals (Buell, 1973). Activities of daily living require additional attention to directions, safety, and location of everyday objects and need more strength, balance, and coordination (Buell, 1973). Kobberling, Jankowski, and Leger (1989) determined .hat individuals with visual impairments expended significantly more energy in running and walking than did sighted individuals. In addition, individuals with visual impairments have increased metabolic demands for most motor tasks because of heightened tension and stress from lack of visual feedback (Buell, 1973; Hladky et aI., 1996; Shephard, 1990). Often, increase in metabolic demand, energy expenditure, and mechanical inefficiency rather than the visual impairment lead to their inactive lifestyle (Auxter, Pyfer, & Heuttig, 1997; Winnick, 1985).

Individuals with visual impairments have the same potential for developing motor skills and fitness as their peers, yet lack of opportunities, limited expectations, and lack of training lead to developmental delays and decreased fitness levels (Adelson & Fraiberg, 1976; Shephard, Ward & Lee, 1987; Sherrill, 1998). Researchers have clearly demonstrated that children with visual impairments who engage in general physical activity programs demonstrate improvements in fitness performance or levels of fitness comparable to sighted peers (Blessing, McCrimmon, Stovall, & Williford, 1993; Gleser, Margulies, Nyksa, Porat, & Mendelburg, 1992; Ponchillia, Powell, Felski, & Nicklawski, 1992). It is imperative to encourage individuals who are blind to participate in physical activity. The physical, social, and psychological benefits of physical activity increase the likelihood of independence and improve their quality of life.

Students attain physical activity in many ways. One that is available to all of them is physical education, which is designed to enhance the development of the psycho motor, affective, and cognitive domains of learning (Rink, 1998). Activities in the psychomotor domain develop and improve physical and motor skills, sport-specific skills, and lifetime activities. In addition, programs may include adventure activities, aquatics, and dance. Promoting team work, cooperation, and appropriate social interactions throughout the program address the affective domain. Finally, activities that require problem solving, critical thinking, and basic understanding of rules and procedures of play enhance the cognitive domain. (Rink, 1998).

Physical education is required by law regardless of a student's ability level. PL 94-142, the Education for All Handicapped Children Act (1975) first cited the inclusion of physical education as a core content area when it defined special education as "specially designed instruction, at no cost to the parent, to meet the unique needs of a handicapped child, including classroom instruction, instruction in physical education, home instruction, and instruction in hospital and institutions." Although PL 94-142 has been reauthorized and amended since 1975, physical education has remained a core content area that must be provided to all students with disabilities. Thus physical education is considered a direct service (Winnick, 1995) as opposed to a related service and therefore cannot be replaced by physical therapy, occupational therapy, Braille class, orientation and mobility training, or speech therapy.

The law also stipulates that each student served under special education must have an Individualized Education Program (IEP) and that physical education be addressed on every IEP. The extent to which physical education is addressed, however, will depend on the unique needs of the student (Houston-Wilson & Lieberman, 1999). Some students with disabilities can participate in unrestricted general physical education and their IEPs reflect "regular" physical education, but the programs of students with visual impairments typically need some modifications for them to be successful (Sherrill, 1998). These modifications may include a guide or peer tutor, beeper or bell balls, or various textured items that would be specifically addressed on the IEP under the accommodations section (Lieberman, 1996). In cases where students possess unique needs that cannot simply be met through modifications, a specialized or "adapted" physical education program must then be developed and provided. Goals and objectives related specifically to physical education would also need to be developed and presented on the IEP. An adapted designation on the IEP does not necessarily mean that the student receives separate physical education. Adapted physical education is a service, not a placement. The environment in which adapted physical education is provided will vary depending on the needs of the student (Winnick, 1995). Least restrictive environment applies to physical education settings. Students with disabilities are to receive the same amount of physical education as their peers of the same age. Other services that students with visual impairments may need cannot conflict with their scheduled physical education time. Although legislation to protect the rights of individuals with disabilities has been in place since 1975, students with visual impairments are still being denied access to appropriate physical education experiences (Sherrill, 1998).

In this article, we plan to highlight major barriers that impede the inclusion of students with visual impairments in physical education and to provide strategies for overcoming those barriers. We primarily address students with visual impairments, but the barriers and solutions presented are also applicable to students who are *deaf-blind.* We collected data about the barriers from surveys completed by more than 170 physical education teachers throughout New York state, who attended workshops on how to include children who are blind in physical education. The New York Commission for the Blind held the workshops in five cities throughout the state. On the basis of the results of the surveys, we have identified attitudes held by teachers, by students with visual impairments, and by school administrators that raise barriers to including visually impaired students in physical education programs.

Teachers' Barriers

Lack of Professional Preparation

Most respondents felt that lack of professional preparation hindered them from appropriately including students with visual impairments in physical education. Preservice physical education teachers receive only limited information about blindness. Typical content on blindness in their course of study includes a simulation, a video, a short lecture, and participation in a game of goal ball. In addition, the amount of information about physical activity given to preservice teachers of the visually impaired usually centers around orientation and mobility, transition, and recreational activities. Such minimal amounts of information in professional preparation programs are simply not enough.

The solution to removing this barrier is to improve professional preparation and in service training for practicing teachers by providing information about strategies for including students with visual impairments into the main content of the curriculum. Information should include ways to modify physical and fitness activities, instructional strategies, and sports and recreational activity resources.

Curriculum and Activities

A second barrier is the curriculum and activities provided in general physical education classes. Activities like basketball, soccer, football, hockey, lacrosse, volleyball, tennis, and badminton in the traditional format are not conducive to independent participation by students who are visually impaired. These activities require visual-motor coordination (i.e., tracking the ball and the opponent) to be successful. These activities should not be prohibited because they can be modified to meet the needs of all students (Lieberman & Cowart, 1996). Examples of those modifications include using auditory balls and goals, slower moving balls, and changing the rules of the game to accomplish the same or similar goals (Lieberman & Cowart, 1996). An even better approach would be to incorporate activities that are independent in nature such as golf, swimming, track and field, martial arts, aerobics, tae-bo, wrestling, gymnastics, weight training, and in-line skating (Lieberman & Taule, 1998). Those choices enhance the independence and opportunities for students who are visually impaired to participate successfully in physical activities.

Pace of the Lessons

Another barrier that impedes the successful inclusion of students with visual impairments in general physical education relates to the pace of the lesson. Teachers may unknowingly move along at a pace that is conducive to learning for sighted students but not for students with visual impairments. Those students .feed specific explanation, demonstration, physical guidance, and feedback regarding skill or activity performance (Lieberman & Cowart, 1996). By the time they understand and elicit the desired movement, the class may have already moved on to another activity.

A solution to removing this barrier would be to change teaching styles from a more teacher-directed (i.e., command style) to a more student centered teaching style (i.e., problem solving, cooperative learning, and guided discovery) (Pangrazi, 1995). Additionally, the use of trained peer tutors or guides may promote a quicker understanding of and response to the desired task and better skill performance (Barfield, Hannigan-Downs, & Lieberman, 1998; Houston-Wilson, Lieberman, Horton, & Kasser, 1997).

Fear, Overprotection, and Limited Expectations

Teachers may see students with visual impairments as incapable of performing various motor tasks and as a threat to the safety of themselves and others within the class. As a result, these youngsters may not be given the same opportunities to perform the same tasks as their sighted peers. Additionally, because they lack training and exposure to students with visual impairments, teachers may be unaware of the potential of those students for physical activity.

In trying to resolve these barriers, teachers should be assured that students with visual impairments are as capable of performing motor tasks as their sighted peers (Norris, Spaulding, & Brody, 1957) and should, therefore, be given the same opportunities for involvement in activities. Although modifications may be needed, such as task analysis, students with visual impairments can be successful in most physical activities. For example, during a gymnastics unit a teacher may be fearful that the student may be injured on the uneven bars. Analyzing the tasks involved in the skill into basic components such as a simple mount, front support, and skin-the-cat would demonstrate that the student has sufficient upper body strength to participate in the gymnastics activities. This approach does not differ significantly from teaching sighted students; it merely demonstrates that given the proper psychological orientation teachers can feel confident about allowing students who are visually impaired to participate in activities similar to their sighted peers. Using the same or equivalent objectives and assessments for students with visual impairments as with sighted students ensures appropriate expectations and adequate challenges to achieve their full potential. Rubrics provide hierarchical levels of skill performance and allow instructors to examine each student individually and determine immediate goals and objectives on the basis of current levels of performance (Block, Lieberman, & ConnerKuntz, 1998).

Students’ Barriers

The attitudes of students with visual impairments can also be a major barrier to their successful inclusion in general physical education. Students mayor may not control these barriers. Many of them arise solely from lack of knowledge and opportunities and from the attitudes of peers, teachers, and parents.

Parental Overprotection

Parental overprotection (Sherrill, 1998) is the first factor that contributes to lack of involvement in physical activities and physical education by students with visual impairments. It is understandable that parents want to ensure their child's safety at all costs, but they may thereby limit their child's ability to interact freely with the environment or their peers. Parents may also assume that their child is unable to perform various motor tasks because of a visual impairment and may request that their child not participate in physical education.

Lack of Opportunities

Opportunities and resources in physical activity programs for these children may be limited. For example, in the early years children who are visually impaired may not have the opportunity to interact with their environment and learn basic fundamental motor skills like climbing, jumping, and skipping or basic object control skills such as bouncing, throwing, or batting (Ferrell, 1984). This early lack of opportunity affects later involvement in typical age-related activities such as gymnastics, soccer, and little league programs.

Lack of Confidence

The lack of opportunities may cause these students to lack confidence and be fearful of participating in typical physical activities. Interviews with 35 students with visual impairments participating in a developmental sports camp revealed the following reasons for refraining from participation in physical activities: low skill levels and fear of ridicule, of losing the game for their team, or of hurting themselves or others (Stuart, 1998).

A solution to those problems includes providing developmental activities at an early age so that children who are visually impaired maintain the developmental skill level of their typical peers. These activities include crawling, rolling, pulling to a stand, walking, and running and should be attained in natural environments such as parks and daycare settings (Drouillard & Raynor, 1977; Ferrell, 1984). Those setting should offer clear pathways with objects to explore at ground level to allow children who are visually impaired to interact with their environment (Drouillard & Raynor, 1977). Schools and recreational programs should have available adaptations to typical sport-related activities so that students who are visually impaired may successfully participate with their same-age peers. Examples of these adaptations are providing sighted guides and making minor modifications of rules for soccer games, peer tutors and task analyses for a gymnastics program, and the use of beeper balls and bases for beep baseball (Lieberman & Taule, 1997). Providing activities that require little or no modifications such as tandem biking, swimming, martial arts, and goal ball will help to increase independence as well as confidence levels.

Administrative Barriers

Administrative barriers involve variables that affect the successful inclusion of visually impaired students in physical education. These include time, equipment, lack of physical education on the IEP, and blanket medical excuses by doctors.

Time

Finding time in the child's schedule for physical education may be a problem. Many children with visual impairments have Braille class, orientation and mobility training, and occupational or physical therapy. Their full schedules may unintentionally deny these students the opportunity to participate in physical education. That practice is unacceptable. Physical education is a direct service required by law under special education (IDEA Amendments, 1997). Activities such as orientation and mobility and physical and occupational therapy may supplement the student's daily motor program, but they may not supplant physical education. Students with a visual impairment must have physical education in an amount of time equivalent to that of their same-age peers. Activities may be adapted to meet the unique needs of the student in either an inclusive physical education class or in an appropriate alternative physical education class. If a student receives modified or alternative physical activities, then those activities must be addressed in the student's IEP, with specific goals and objectives for those activities written on the IEP (Houston- Wilson & Lieberman, 1999). When students with visual impairments participate in unrestricted physical education activities, the IEP should state that the student receives regular physical education with no modifications (Houston-Wilson & Lieberman, 1999).

Lack of Appropriate Equipment

Some students with visual impairments may benefit from beeper balls and goals, bell balls, larger and brighter equipment, equipment that may be costly and prohibitive within the current school budget. However, when this equipment is requested and agreed on during IEP meetings, the school district must provide it. Therefore, it is imperative that either the physical education teacher or a knowledgeable representative speak to the physical education needs of the student at IEP meetings (Sherrill, 1998).

Blanket Medical Excuses

The last variable is blanket medical excuses from physicians or ophthalmologists that prohibit the student from any involvement in physical education or physical activities. Retinal detachment, glaucoma, or other visual conditions often cause doctors, parents, and school administrators to be fearful and to restrict a student's participation in physical education. These blanket medical excuses, by denying students the opportunity to participate in the same or equivalent activities as their peers, may impede the quality of life for the visually impaired child. Physical education exposes students to the values of physical activity for life-long health benefits and the pursuit of life-long recreational and sporting activities. Blanket medical excuses are unnecessary because adapted physical educators are trained to consult with doctors, teachers, administrators, and parents to develop a safe, successful, and appropriate program to meet the unique needs of a student.

Summary

In this article we have identified the major barriers associated with teachers, students with visual impairments, and school administrators that impede the inclusion of visually impaired students in physical education and physical activity programs. We have also offered solutions to remove those barriers. It is imperative that students with visual impairments be afforded opportunities to participate in a variety of age-related physical activities that are the same or equivalent to those of their sighted peers. Having those opportunities enhances their quality of life. Through the combined efforts of parents, teachers, administrators, and the individuals themselves, major barriers can be overcome to make those goals achievable.

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HARD-OF-HEARING OR *DEAF:* ISSUES OF EARS, LANGUAGE, CULTURE, AND IDENTITY

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Most social work caseloads include some people who are ***deaf*** or hard-of-hearing, yet few social workers are attuned to the different and subtle ways in which hearing impairment can affect identity and relationships. People with hearing impairment make many self-defining choices-of communication method; language; and social, cultural, and political allegiance. Using information collected during a three-year research study of people with acquired hearing loss, this article defines and describes the complex and interrelated dimensions involved in assessing and serving people who are ***deaf*** or hearing impaired.

Key words: culture; deafness; hearing impairment; self-identity

Hearing impairment is one of the most common of all chronic disabilities, and it affects people's lives in profound and all-encompassing ways. People with hearing loss are subject not only to the particular difficulties that their disability might create, but also to any social or psychological problems that might require social work intervention. It is important, then, that all social workers understand the differences among ***deaf*** and hearing-impaired people and have tools for assessing the meaning of hearing loss for a particular client.

About 8 percent of all people have a significant hearing loss, and many more have losses classified as mild or moderate. Both prevalence and severity of hearing loss increase dramatically with age (Glass, 1985; Ries, 1985); the incidence of self-reported trouble with hearing is 33 percent for people ages 65 to 74 and 62 percent for people older than age 85 (Havlik, 1986). In contrast to the high prevalence of hearing impairment, only 1 percent of the population is profoundly ***deaf***, and of those, only 22 percent (.22 percent of the whole population) lost their hearing before age 19 (Schein & Delk, 1974). People who were born ***deaf***, then, actually are a very small percentage of the hearing-impaired population.

Project on Adult Onset Hearing Loss

The project on Adult Onset Hearing Loss was established in 1989 at the University of California, San Francisco, to explore the psychosocial and vocational characteristics and needs of people who had lost their hearing during adult life. The project was supported in part by a grant from the National Institute on Disability and Rehabilitation Research.

After conducting focus groups with 70 adults with acquired hearing loss in the San Francisco Bay Area, the project recruited people willing to participate in a three-hour, comprehensive, semi structured interview. Recruitment was done through two national self-help organizations: Self Help for Hard of Hearing People and the Association of Late Deafened Adults. Members of those groups were asked to submit names of people they perceived as coping successfully with adult onset hearing loss. Respondents could nominate themselves as well as others. The project staff interviewed 130 people in all, 104 of whom had an adult onset hearing loss.

All subjects were English speaking. The median age was 51. Sixty-eight percent of the respondents were female. Sixty-two percent had worked in administrative or professional positions. Sixty-six percent had earned a college or graduate degree, and 19 percent had completed community college or a special training program. Sixty-one percent of the respondents described their income level as comfortable or affluent, 32 percent as adequate, and 7 percent as marginal.

Some Limits of Labels

Statistics alone demonstrate that there are differences within the hearing-impaired population, most notably in degree of hearing loss and age at onset. But labels and categories cannot predict how individuals communicate or where they feel comfortable. By convention, *"**deaf**"* refers to an audiological condition or absence of hearing; *"**Deaf**"* means culturally ***deaf*** and implies membership in a community. These designations will be used throughout this article. Examples of how labels differ are shown in the following portraits:

Andrew seems to hear nothing. He understands speech only if it is very slow and clearly directed to him. He does not startle when a door slams. But he will tell you that he is not ***deaf***, he is hard-of-hearing.

Paula understands more speech than Andrew, but she prefers to use sign language. With her hearing aid on, she hears her doorbell. She bristles at the label hearing impaired. "I'm not 'impaired,'" she says. "I'm ***Deaf***"

After losing her hearing suddenly from tumors, Lisa enrolled in a sign language class. One day she decided to try out her new skills at a club for ***Deaf*** people. Using the signs she knew, she explained repeatedly that she too was ***deaf*** But people did not seem interested in talking with her. In words and behavior she was told throughout the evening that she probably was not ***Deaf*** and she certainly did not belong.

As these composite portraits illustrate, self-definition--as ***deaf***, ***Deaf***, deafened, hard-of-hearing, or hearing impaired--is a complex issue. Some of the factors involved, paradoxically, have little to do with hearing level. To understand, social workers must look at the complicated and interrelated dimensions of hearing, language, culture, and politics.

Hearing and Communication

Audiologically, hearing can be limited in any degree and in any combination of pitches (frequencies). Hearing loss can affect both the volume and clarity of sound. A loss of volume can often be corrected well with hearing aids. Hearing aids can sometimes offer limited help with problems of clarity, but most people with this problem report that they hear but do not fully understand. For some people, these challenges are compounded by tinnitus--noises from inside the ear that are unrelated to sounds in the environment.

The most damaging thing about hearing loss is that it interferes with communication. Some people with hearing loss are able to understand speech by discerning meaning from fragments of sound, supplemented by visual clues from people's lip movements and facial expressions. This skill, speechreading, is difficult and taxing. Some people seem to have a talent for it, and others do not. Facility with the language being spoken helps, as does knowledge of the subject matter, good vision, confidence, relationship skill, and reasonable freedom from stress (Lucy, 1980). Even at best, however, speechreading is demanding, tiring, and only partially accurate.

Generally, the worse hearing becomes, the harder it is to speechread and the more likely it is for people to think of themselves as ***deaf*** rather than hard-of-hearing. The people in our study described the different meanings that change in self-definition might have:

I was profoundly ***deaf***, but my audiologist, bless her heart, never used the word with me. So I ... learned to live my life as if I was just "hard-of-hearing." And then I found out that I was ***deaf***

For me, it is better being ***deaf*** than it was being hard-of-hearing. I know who I am. I know what I can and cannot do, whereas when I was hard-of-hearing, I never knew from day to day or hour to hour what I could and couldn't hear, and I tried so hard. This is so much easier.

Many people who see themselves as ***deaf*** choose to use a visual communication system as a supplement to or even a substitute for speechreading. That choice requires willingness both to learn a new system and to make yet another shift in self-definition:

I don’t sign. I think to do that is [in] some way to acknowledge something I don’t want to acknowledge yet.

Language Experience and Choice

To understand how people communicate, it is essential to know not only what mode they use (speech or speechreading, sign, or writing), but also what language. Although speech and writing will almost always be in English or the person's native spoken language, manual communication has many forms. Some sign systems are visual representations of English. American Sign Language (ASL), on the other hand, is a distinct and complete language and the native language of ***Deaf*** Americans. Understanding how English and ASL differ requires some knowledge of the ways in which language first develops.

Children with normal hearing learn to communicate in the language of their families and communities. When hearing loss begins in infancy or early childhood, it interferes with the child's exposure to spoken language. How well a child compensates depends on many factors, including the nature and severity of the hearing loss; family involvement; motivation; talent; and access to information, services, and educational options.

Some children who are born ***deaf*** or who lose their hearing in infancy or early childhood do not use a formal language fluently and easily until they enter an environment in which ASL is the dominant language--usually a residential school for ***deaf*** children. In such environments, almost all children become fluent in ASL. Many also become bilingual--readers, writers, and sometimes speakers of English--with varying levels of fluency. Despite the fact that ***Deaf*** children tend to learn ASL with relative ease, few people who become ***deaf*** as adults find ASL relevant to their lives at all. Of those who choose to study it, only a minority ever become truly fluent.

The vast majority of people with hearing loss consider English (or the language of their culture) their first language. Within this group are people who grew up hard-of-hearing or ***deaf*** and who continue to communicate primarily by speaking or speechreading (aided by the use of residual hearing). In addition, there is a larger group who acquired their hearing loss later in life, after language and communication methods were established. If the hearing loss is severe, members of either group sometimes supplement their speechreading with a manual communication system that follows the linguistic structure of English--signed English. Cued Speech is yet another system; it is phonetically based and uses handshapes to represent specific speech sounds. All of these approaches are designed to enable an individual to communicate in English.

Culture

People whose primary language is ASL tend to come together. Such groups have existed for many generations and have established a particular culture. Many people marry within the culture and affiliate with formal and informal organizations that are part of it. In addition to language, the culture includes particular behaviors, norms, and beliefs.

People who have been affiliated primarily with the speaking and hearing world are generally aliens in the ***Deaf*** culture; they do not speak its language or understand its ways:

I went to ***Deaf*** family camp once and I was astounded. Everyone who was married had a spouse like them .... And here I was .... My hearing was not different than some of them, and yet I have a hearing husband and all my kids were hearing.

I had realized that most of the congenitally ***deaf*** I really don't connect with. It's like I can learn sign, but I'm not as skilled as a congenitally ***deaf*** person. I don't have their culture.

Another significant difference between culturally ***Deaf*** people and those who have become ***deaf*** are their feelings about deafness itself. People in the ***Deaf*** community and culture tend to perceive deafness not as a disability, but as an alternate lifestyle and culture (Padden & Humphries, 1988). Those who become ***deaf***, on the other hand, miss their earlier access to spoken communication, and they miss sound. For them, deafness is both a disability and a loss; it is something to be mourned:

Many is the time that I have cried myself to sleep because of my hearing loss. Especially after sessions of lovemaking with my husband. I could not hear what he was saying to me. And I would want to talk to my children over the telephone, and "I can't hear you, I can't understand you." It was pretty bad. A couple of times I contemplated suicide.

[My doctor] said to me, "Aren't you lucky that you had your education behind you." I hated that man for saying that. I'm going to be ***deaf*** and he says I'm lucky.

Although most people with acquired hearing loss strive to maintain their familiar social and cultural world, some choose a partial affiliation with the ***Deaf*** culture (Wax, 1989). None of the people in our study ever became fully integrated into the ***Deaf*** community, but a few developed some significant ties to it:

Learning about ***Deaf*** people made being ***deaf*** not so frightening and being able to help people again was really helpful to me.

Because of being ***deaf***, I became aware of minority groups, and the feeling of oppression ... of not being equal to other people. I never saw that before .... Then, I wanted to do something .... So that's when I started volunteer work to help get better rights, equal rights, better laws for ***deaf*** .. or hearing-impaired people.

The people who had built such bridges tended to be those who had lost their hearing early in their adult life, before social identity and vocational choices had been firmly fashioned.

In recent years, people with adult onset hearing loss have formed groups and organizations to address their social, cultural, and political interests. Self Help for Hard of Hearing People (SHHH) largely comprises culturally hearing people with relatively severe hearing losses. SHHH members usually are not comfortable with the word *"**deaf**"* and generally communicate by speechreading aided by special amplifying devices. Few SHHH members use manual communication of any form; some are beginning to use speech-to-text technology. SHHH members are largely middle class and middle age or older.

Association of Late Deafened Adults (ALDA) members have become profoundly ***deaf*** as adults. ALDA members tend to be younger than SHHH members, are ready to define themselves as ***deaf***, and are interested in visual systems of communication. A high percentage of ALDA members have learned at least some sign language, and computer-assisted captioning is used routinely (Howe & Graham, 1990).

In many communities, there are local support groups for people with different kinds of hearing loss and language preferences. Some are affiliated with service agencies, and some are informal networks.

Politics

I started to feel that some ***Deaf*** people resented me and didn't think I was ***deaf*** They said "She's ***deaf*** but she signs like a hearing person." I was always made to feel that I was a hearing person and that I shouldn't be taking on a leadership role.

In addition to a shared culture, the ***Deaf*** community has a political agenda. Many culturally ***Deaf*** people have suffered misunderstanding and overt discrimination from the hearing world. Group members tend to see themselves as fellow victims of oppression. Some ***Deaf*** organizations are active in efforts to promote acceptance of ASL and recognition of the rights and abilities of ***Deaf*** citizens.

People who are not fluent in ASL, not culturally at home in the ***Deaf*** world, and not conversant with its political issues are likely to be perceived by the ***Deaf*** community as "hearies," regardless of their actual ability to hear. To ***Deaf*** people, the hearies represent a world that is at the very least different and, at worst, oppressive.

Hard-of-hearing, ***deaf***, and deafened people also experience discrimination and misunderstanding. Many of them also have a political agenda. In some ways, their agenda overlaps that of the ***Deaf*** community. Like the ***Deaf*** community, SHHH and ALDA strive to increase community understanding about the rights and needs of hearing-impaired people. For example, all groups are trying to make television coverage of emergencies accessible to ***deaf*** and hearing-impaired people, both through captions and sign language interpreting. But SHHH has a particular interest in making assistive listening devices available in public places, whereas ALDA emphasizes expansion of text-based systems, such as real-time captioning. In their different ways, SHHH and ALDA strive to make spoken English more accessible to their constituents. Because their agenda is unrelated to ASL, it is perceived by some members of the ***Deaf*** community as a threat to ***Deaf*** language and culture.

Implications for Social Work

The first thing a social worker needs to do when meeting a ***deaf*** or hard-of-hearing client is establish a way to communicate. A primary question is what language the client knows and prefers. Because most hearing-impaired people are not culturally ***Deaf***, most clients with hearing loss will have good speech ability and prefer English or the spoken language of their culture. If the client speechreads, the social worker can help by finding a quiet, well-lit place to talk. He or she should face the client; speak slowly and clearly; rephrase anything the client misunderstands; and offer to write key words, names, or specific information. Some clients with good speech and knowledge of English prefer to involve an interpreter for important interactions, and they are entitled to that accommodation. Professional interpreters for the ***deaf*** are able to use both signed English and ASL and to select the language suited to the individual and situation.

Deaf clients who prefer ASL to English may state their preference directly or may show it in other ways, perhaps by not understanding spoken or written English or by writing in a way that seems unclear, awkward, or not idiomatic. It is important to remember that writing is not an adequate accommodation when working with such a client. Effective communication will require the involvement of a fully qualified, professional interpreter and possibly consultation from a specialist in deafness. Using a family member as a volunteer interpreter is not appropriate; it can violate a client's right to privacy and introduce bias into the communication process.

ASL is, as its name suggests, American. ***Deaf*** people from other countries may use a different sign language and need a highly specialized interpreter. Some interpreters know sign systems other than ASL, and some are able, through gestures and mime, to communicate with those ***Deaf*** people who, for a variety of reasons, have not learned any formal language at all. Once communication has been established, the focus needs to move away from hearing and back to the issue that brought the client to the social worker in the first place. In the course of this work, it is important to remain mindful of the impact of hearing loss on the client's life and situation. Particularly if recently acquired, hearing loss is likely to be a major clinical issue, affecting the client's relationships, work life, inner feelings, and response to particular services or programs. For other clients, most often those who have lived with deafness or hearing loss for many years, hearing status may be simply a given, a part of the context of life, and something to be accommodated, not stressed.

Hearing impairment can be an isolating condition, and some clients might want to make connections with other people or groups who can offer companionship, support, and a sense of shared mission. Before making referrals, however, the social worker must be aware of pertinent social, cultural, and political characteristics both of the client and of the group being considered. The right connection can help immensely:

I get a tremendous amount of support in empathy, in knowing that I'm not alone ... that other people have problems in the same areas that I have ... how much we have in common.

But the wrong connection can leave people feeling more isolated than ever:

The rehabilitation counselors tell us to learn ASL when we have no use for ASL ... It's aggravating. I get very angry with it.

Conclusion

Understanding a person with a hearing loss is a complex and specialized clinical challenge. To be of help, a social worker must join each ***deaf*** or hearing-impaired person in a full and multifaceted exploration of all pertinent dimensions of life--hearing, communication, language, culture, and politics. The process takes time and may at first seem remote from the problem at hand. But the exploration is essential for developing a positive relationship, for assessing needs accurately, and for delivering high-quality service.

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Title: The Laurent Clerc National ***Deaf*** Education Center.

Subject(s): LAURENT Clerc National ***Deaf*** Center (Washington, D.C.); CHILDREN, ***Deaf*** -- Education -- Washington (D.C.)

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Author(s): Marshall, Stephanie; Nussbaum, Debra

Abstract: Features the Laurent Clerc National ***Deaf*** Center in Washington, D.C., which offers educational programs and resources for ***deaf*** students and their families. Audiology services offered; Beliefs, activities and strategies employed by the center; Projects facilitated by the center; Details on the plan to establish Cochlear Implant Center.

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Best Part

Section: Where We Work

THE LAURENT CLERC NATIONAL *DEAF* EDUCATION CENTER

The Laurent Clerc National ***Deaf*** Education Center may be hidden in a comer of the campus of Gallaudet University in Washington, DC, but its influence can be felt well beyond the nation's capital. Our educational programs and resources for students who are ***deaf*** and their families span the United States.

The Clerc Center includes two components: our demonstration schools--Kendall Demonstration Elementary School (KDES) and the Model Secondary School for the ***Deaf*** (MSSD)--and our national programs. Both components seek to identify, implement, research, and disseminate innovative curricula, materials, educational strategies, and technologies for students with hearing loss. Our publications and resources are available to you, many at no charge, and our Web site (http://clerccenter.gallaudet.edu) includes extensive in-depth information and links to further resources.

Our demonstration schools serve a wide range of students. The tuition-free programming starts at birth, continues through high school, and serves students who reside throughout the DC metropolitan area for the elementary and middle school levels, and throughout the nation for the high school level. We serve students from diverse cultural backgrounds with a wide range of hearing ability. There are no specified hearing level criteria to attend our programs. Hearing loss must be a child's primary disability, and its degree must be significant enough to warrant an educational environment that incorporates visual language support.

Audiology Services

Audiologists and speech-language pathologists (SLPs) are integrated into our educational programs as part of the Support Services Team (SST). The SST is a multidisciplinary group comprising diverse professionals with specialized skill working with children who are ***deaf*** in the areas of psychology, social work, counseling, occupational and physical therapy, and medical services. Services also include consultation by area otolaryngologists and psychiatrists. Specialists assist students in their personal, social communication and in their academic development using an integrated service model that strongly emphasizes collaboration with instructional teams and family members.

To support auditory and speech development we have a wide array of diagnostic and habilitative services. Audiologists and SLPs provide collaborative services both in and out of the classroom to support the needs of each child and family. Audiologists are available on site for services related to monitoring hearing levels and middle ear status and assessing functional listening/ speechreading skills. Audiologists also provide earmold impressions and hearing aid evaluations, monitoring, and minor repairs. Habilitative services are provided collaboratively with teachers, other multidisciplinary specialists, and families to assure that auditory and speech services are integrated in a comprehensive way within the educational and home environments.

As we address programming for auditory and speech development, our goal is for all students to become effective communicators. We aim for students to achieve, to the best of their ability, a full repertoire of linguistic and communicative competencies to use in interactions both with people who are *deaf* and those who hear. The auditory and speech communication program supports this outcome by empowering students through knowledge of, exposure to, and experimentation with a variety of communication skills and strategies to expand their options and help them make decisions regarding their communication preferences.

Beliefs, Activities, and Strategies

Our programs strongly support early amplification use and integration of auditory and speech services. At the same time, we are sensitive to the visual language needs of each student and are careful to promote realistic expectations and goals. We are keenly aware that all children may not become "talkers"; however, they will all need to be communicators and English language users. Our auditory and speech-language skill development services therefore extend beyond traditional training of specific listening and speech skills, and include skill development in areas that affect each child's overall language, communication, and literacy development. For example, in addition to traditional attention to listening and speaking, services also focus on use of mouth movement, relating mouth movement to print, use of pragmatic skills, use of assistive technology, and building bridges between American Sign Language (ASL)and English.

Audiologists typically may not have the opportunity to be integrated into a child's educational programming. At the Clerc Center, however, they have the unique chance to provide services and incorporate innovative strategies to support auditory and speech development directly into the child's day-to-day life.

In addition to our direct service provision, we address the Clerc Center priority areas of literacy development, family involvement, and transition. Literacy development, although crucial to all children, is an area requiring more specialized focus for children who are ***deaf*** Our auditory and speech specialists use many strategies to address this.

One strategy includes Visual Phonics, which is a system that utilizes 46 hand cues and corresponding written symbols and is showing promise in helping our children who are ***deaf*** approach the reading process. Students are making connections between what they see on the lips, what they say, and what they read. (For more information about Visual Phonics, email Bettie Waddy-Smith at Bettie. Waddy-Smith@Gallaudet.edu).

Another strategy used to address literacy development incorporates the use of various forms of read-aloud activities. These activities provide students with opportunities to make connections between sign language and printed English as well as spoken language.

Family involvement is central to our programming at all ages. When families are not interacting directly in school with communication specialists, home/school communication books, videotaped treatment sessions, email, phone, and written correspondence become integral to our services. All of our activities in communication planning have been developed to address the needs of our students related to their successful transition to life beyond school.

Some of the special projects that we have been working on recently to facilitate this transition include:

Projects

- Listening/Literacy Stations--At the elementary and high school levels, students are given the opportunity to listen to music, books, or poems on audiotape and/or videotape. The printed text and corresponding tapes address literacy skill development and, at the same time, allow students to develop their listening skills. Videotapes and audiotapes for the stations are primarily developed in-house and support themes and activities of the classroom.

- Assistive Devices Center--A realistic, home-like environment has been created to display and demonstrate assistive listening and alerting devices in an attractive and inviting setting. This center is used. to support literacy development as well as student and family education related to training with and exposure to these devices.

- Communication/Life Skill Labs--Older elementary and middle school age students participate in labs to address essential survival skills and communication strategies that will assist them in becoming self-reliant. Sessions focus on mastering emergency contact information, using assistive device technology, understanding individual communication strengths/weaknesses, and applying survival skill strategies to everyday communication situations and safety. At the high school, lab activities extend to helping students make the transition to post-secondary school programs or employment. Students are involved in practical activities to promote development of communication competencies and self-assessment of future communication needs so they can advocate for their consumer rights and needs beyond high school.

Our Other Responsibilities

Working at the Clerc Center brings opportunities to engage in activities beyond direct service provision. We are actively involved with sharing information related to best practices in audiology and communication training through publications, presentations, workshops, phone contacts, and meetings with national and international visitors to our programs. Our location on the campus of Gallaudet University also offers the perfect chance to collaborate with graduate programs in audiology and speech-language pathology. University students get first-hand experience working with children who are ***deaf*** This, in turn, affords them the opportunity to use and share what they have learned at their future places of employment.

Cochlear Implant Center

As the population of children who are ***deaf*** and have cochlear implants expands to include children of younger ages, a new generation of children with unique needs is emerging.

The Clerc Center is currently investigating the establishment of a Cochlear Implant Center to implement and evaluate quality programming for this population. We will be looking at strategies to promote optimal development of spoken language as well as ASL. Our goal is for children with implants to develop spoken language to their potential in an environment that also addresses their visual language needs, especially during critical language-development years. We hope to establish programming to address the overall educational, communication, and social-emotional needs of students with implants. With careful planning and support, we are seeking to provide educational programming that will be a first-choice option for families of children obtaining implants.

Balance

Working at the Clerc Center provides clinicians the unique opportunity to balance the diagnostic, habilitative, and educational needs of students who are ***deaf*** With the increase in newborn infant heating screening and improved technologies to support children identified with heating loss, programming needs for this population are expanding rapidly. It is important that we keep up with the needs of this population. We are committed to identifying, developing, and disseminating successful practices and programs to improve learning for students who are ***deaf*** that will also promote positive social-emotional development and establish competencies necessary for them to face life challenges beyond high school. We welcome your input on successful practices you have experienced with this population and urge you to take advantage of the many resources available to you at the Clerc Center.

Rave Reviews for “Read-Aloud/Read-Along”

The expanding role of audiologists at the Clerc Center involves integration of auditory and speech habilitation into the instructional teams. An activity that has received rave reviews from the students this year is "oral read-aloud/read-along time." This small group activity promotes listening and literacy skill development for students who have sufficient residual hearing. Interestingly, one student who depends on American Sign Language (ASL) for communication and learning asked to join the group. Modification of this activity through use of an ASL interpreter and individualized goals made this possible.

The audiologist, facilitating connections between the spoken word and print, reads aloud to students as they read silently from the same book. The session becomes an interactive process where listening skills are addressed, language concepts are introduced and expanded upon, and literacy skills are developed at the same time.

The activity motivates students and also appears to be improving overall reading comprehension. Students are assessed using a computerized reading comprehension test that is a component of their classroom reading program.

Although there are a variety of factors affecting scores, students have shown better reading comprehension during this activity than in independent sessions. Students involved in this activity also demonstrate increased auditory recognition of words, printed vocabulary, and word-attack skills. An additional advantage of read-aloud/read-along time is having the opportunity to present books at slightly higher reading levels than the students' current independent reading level. Students are thus exposed to increased language, vocabulary, and content.

PHOTO (COLOR): Debra Nussbaum works with Marie Johnson, who has a cochlear implant, in the parent-infant program.

PHOTO (COLOR): Stephanie Marshall helps Anthony Dixon practice using the TTY in the Assistive Devices Center.

PHOTO (COLOR): Marshall works with a small group of students during an oral read-aloud/read-along session. Barbara Hunt interprets in ASL for one of the students.

3.
By Stephanie Marshall and Debra Nussbaum

Stephanie Marshall is an audiologist who has worked at the Clerc Center for 12 years with students ages 8-21 and their families. Contact her by email at Stephanie.Marshall@Gallaudet.edu

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Target Groups, Competitive Jobs, and Selected VR Services

Last, two-way interactions among type of hearing loss, work status at closure and selected VR services (i.e., college or university training, business and vocational training, on-the-job training, and job placement) were examined. Interaction models were created by separating the group that received each of the VR services from the group that did not receive the service. Subsequent chi-square analyses evaluated the relationship between type of hearing loss and work status at closure. Thus interactions were interpreted by comparing the contingency table cells (chi square) for type of hearing loss and work status only for those consumers who were provided with each of the VR services. Two-way interactions were identified for further analysis: type of hearing loss by college or university training, by business and vocational training, by on-the-job training, and by job placement.

Interaction effects indicated nonsignificance for type of hearing loss by college or university training, chi[sup 2](2, N = 1,789) = .903, P > .01, by business and vocational training, chi[sup 2](2, N = 1,122) = .118, p> .01), and by on-the-job training, chi[sup 2](1, N = 1,092) = .398, P > .01 (see Table 3). That is, for those consumers who received these services, ***deaf*** consumers did not achieve competitive jobs at a significantly higher rate than consumers who were late-deafened and hard-of-hearing. However, interaction effects did indicate a significant association between type of hearing loss and job placement, chi[sup 2](2, N = 5,267) = 48.524, P < .01. That is, although all three comparison groups received job placement services, ***deaf*** consumers obtained competitive jobs at a significantly higher rate than consumers who were hard-of-hearing or late-deafened.

A closer inspection of job placement, utilizing post hoc pairwise comparisons, revealed nonsignificance for ***deaf*** versus late-deafened, chi[sup 2](1, N = 2,740) = 2.702,- P > .003, and late-deafened versus hard of hearing, chi[sup 2](1, N = 2,663) = .593, P > .003, but significance for ***deaf*** versus hard-of-hearing chi [sup 2](1, N = 6,131) = 48.570, P < .003 (see Table 3). That is, consumers who were ***deaf*** and who received job placement did not achieve competitive jobs at a significantly higher rate than consumers who were late-deafened. Similarly, consumers who were late-deafened did not achieve competitive jobs at a significantly higher rate than consumers who were hard-of-hearing. However, ***deaf*** consumers did achieve competitive jobs at a significantly higher rate than consumers who were hard-of-hearing.

DISCUSSION AND IMPLICATIONS FOR REHABILITATION

This study finds that consumers who were late-deafened and hard-of-hearing achieved competitive jobs at a significantly lower rate than consumers who were ***deaf*** These findings also suggest that consumers who were provided with college or university training, business and vocational training, on-the-job training, or job placement were significantly more likely to achieve competitive jobs than consumers who were not provided with such services. These findings also reveal that consumers who were ***deaf*** were provided with significantly more college or university training, business and vocational training, on-the-job training, and job placement than consumers who were late-deafened and hard-of-hearing. There are two basic implications for current practice.

First, the results of this study could serve as an explanation for the significantly lower numbers of consumers who were late-deafened and hard-of-hearing who achieved competitive jobs. In short, consumers who were late-deafened and hard-of-hearing were not provided with effective training (i.e., college or university training, business and vocational training, on-the-job training) and with job placement services at the same rate as consumers who were ***deaf*** It should be noted that some VR counselors may have assumed that consumers who are late-deafened and hard-of-hearing were less likely to benefit from such services. Nonetheless, VR counselors may want to inform VR consumers of the availability of such services by incorporating such information in their Individualized Plans for Employment.

Second, the administrators for the 56 state and territorial VR agencies might consider implementing a Model State Plan (MSP) for delivery of VR services to persons who are late-deafened and hard-of-hearing within each of their regions. This MSP might call for the development of a vocational rehabilitation specialty in serving consumers who are late-deafened or hard-of-hearing. Also, there could be a call for greater numbers of such specialists to serve those consumer populations within each state. This development could enhance those numbers of consumers who are late-deafened and hard-of-hearing who achieve high-quality employment outcomes, namely, competitive jobs.

FUTURE RESEARCH

Three measurement validity issues that could limit the findings of the current study warrant further attention. First, it is possible that 90-day maintenance of employment (Status 26) does not accurately reflect maintenance of competitive jobs. It is conceivable that a longer duration of time is needed to substantially improve one's work independence. Second, it is possible that groups of consumers who achieved competitive jobs at greater rates simply received a VR service (or services) for longer periods of time. Third, it is possible that persons who achieved competitive jobs received a better quality of VR services. 'The dependent measure (RSA-911 database) does not contain any information as to the quality of the services. Consequently, there is no way of knowing if all consumers received the same quality of each service.

Therefore, future research may warrant the use of data collection procedures that include face-to-face personal interviews with consumers rather than relying on an archival study. Such data collection methods may limit the aforementioned plausible threats to the internal validity of the current study. Further, an extension to the 90-day criteria of maintenance of competitive jobs may provide more valid data to evaluate work status at closure. Future research questions may include the following: (a) Is duration of reception of VR services significantly associated with achieving competitive jobs? (b) Is quality of VR services significantly associated with achieving competitive jobs?

Furthermore, this study's findings raised questions that could not be addressed in the current study due to limitations of the RSA-911 database. For example, the RSA-911 does not provide any information regarding the type of job placement techniques employed by VR counselors. In particular, there may be a need for additional scientific inquiry to shed light on those job placement services (i.e., job analysis and job matching) whose lack negatively impacts competitive job prospects for those consumers who are hard-of-hearing. Two questions thus are: (a) What types of job-analysis procedures are associated with achieving competitive jobs for persons who are hard-of-hearing? (b) What types of job-matching techniques are associated with achieving competitive jobs for persons who are hard-of-hearing?

This study is merely one look at the complex issue of achieving competitive jobs. Its findings clearly document that the federal-state vocational rehabilitation system provides services that lead to positive employment outcomes for a significant number of persons who are ***deaf,*** late-deafened, and hard-of-hearing. It is hoped that these findings will be used to focus and guide service delivery efforts and prompt other research. For example, researchers might want to extrapolate state-specific cases from the national RSA-911 and replicate the current research design. Meaningful comparisons between state findings and these national benchmark findings might cross-validate the current findings and also assist in the development of a more effective VR service delivery model for all persons with hearing loss. It is only through strong research collaborations between state VR agency representatives (e.g., administrators and practitioners) and professional rehabilitation researchers (i.e., those associated with rehabilitation research and training centers) that meaningful VR service to all persons with hearing loss can be achieved, ultimately improving their prospects for competitive jobs.

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TABLE 1. Logistic Regression Results for the Relationship Between VR Services and Work Status at Closure

Legend for Chart:

A - Variable
B - B
C - SE
D - R[sup 2]
E - p

A	B	C	D	E
College or university training		.14	.01	.000(*)
Business and vocational training	.69	.14	.01	.000 (*)
On-the-job training	1.15	.14	.02	.000 (*)
Job placement	1.14	.06	.03	.000 (*)
Maintenance	.00	.03	.00	.999

Note. N= 15, 248.
(*) p< .01

TABLE 2. Chi-Square and Post Hoc Results for the Relationship Between Hearing Loss Groups and Types of VR Services

Legend for Chart:

A - Variable
B - chi [sup 2]
C - df
D - p

A	B	C	D
Hearing loss by college/university	276.217	2	.000 (*)
Late-deafened vs. hard-of-hearing	0.001	1	.970
Deaf vs. late-deafened	50.391	1	.000(*)
Deaf vs. hard-of-hearing	252.966	1	.000(*)
Hearing loss by business/vocational	100.092	2	.000(*)
Late-deafened vs. hard-of-hearing	0.040	1	.841
Deaf vs. late-deafened	12.807	1	.000 (*)
Deaf vs. hard-of-hearing	96.349	1	.000 (*)
Hearing loss by on-the-job training	153.955	2	.000 (*)

Late-deafened vs. hard-of-hearing	4.670	1	.031
Deaf vs. late-deafened	16.922	1	.000 (*)
Deaf vs. hard-of-hearing	149.030	1	.000 (*)
Hearing loss by job placement	601.235	2	.000 (*)
Late-deafened vs. hard-of-hearing	6.317	1	.012
Deaf vs. late-deafened	124.710	1	.000(*)
Deaf vs. hard-of-hearing	561.243	1	.000(*)

Note. Analyses involved only participants who were provided with college/university training, business/vocational training, on-the-job training, or job placement services.
(*) p< .001.

TABLE 3. Chi-Square Results for Proportion of VR Services Received by Type of Hearing Loss

Legend for Chart:

A - Variable
B - chi [sup 2]
C - df
D - P

A	B	C	D
Hearing loss by college/university	.903	2	.637
Hearing loss by business/vocational	.118	2	.731
Hearing loss by on-the-job training	.398	2	.820
Hearing loss by job placement	48.524	2	.000(*)
Deaf vs. late-deafened	2.702	1	.100
Late-deafened vs. hard-of-hearing	.593	1	.441
Deaf vs. hard-of-hearing	48.570	1	.000(*)

Note. Two-way interactions. Analyses involved only participants who were provided with college/university training, business! vocational training, on-the-job training, or job placement services.
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(*) p< .001.

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Author(s): Powers, Steve

Abstract: This paper describes a study of reported good practice in ***deaf*** education and discusses some of its main findings. A postal questionnaire was used to ask a wide number of parents, teachers and others for their views on the constituents of good practice in ***deaf*** education and to recommend schools. A selection was made from the nominations and a number of case studies undertaken across a range of educational approaches and placements. The findings discussed here concern the support of ***deaf*** pupils in mainstream schools. *[ABSTRACT FROM AUTHOR]*

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INVESTIGATING GOOD PRACTICE IN SUPPORTING *DEAF* PUPILS IN MAINSTREAM SCHOOLS

ABSTRACT This paper describes a study of reported good practice in ***deaf*** education and discusses some of its main findings. A postal questionnaire was used to ask a wide number of parents, teachers and others for their views on the constituents of good practice in ***deaf*** education and to recommend schools. A selection was made from the nominations and a number of case studies undertaken across a range of educational approaches and placements. The findings discussed here concern the support of ***deaf*** pupils in mainstream schools.

Introduction

The confusion surrounding the use of the term' inclusion' in the education of ***deaf*** children has been discussed by the writer elsewhere (Powers, 1996a, 1 996b) and in those articles he suggested some indicators of 'tree inclusion' for ***deaf*** pupils. In this paper the focus is more on the day-to-day concerns of those teaching and supporting ***deaf*** pupils in mainstream schools. Some findings am reported from the Review of Good Practice in ***Deaf*** Education, a recent investigation commissioned by the Royal National Institute for ***Deaf*** People (RNID) (Powers et al., 1999). While ***deaf*** children in the UK are sometimes placed in special schools for ***deaf*** children and sometimes in other special schools, the data reported here only concern pupils placed in mainstream schools. Stone of these pupils attended specially resourced schools for ***deaf*** children ('units') while others were individually placed in mainstream schools. The ***deaf*** pupils in units were supported by teachers of the ***deaf*** (ToDs) based in those schools while pupils individually placed in mainstream schools were supported by peripatetic (visiting) To Os who were employed by the local education authorities (LEAs).

It is important to say what the Review of Good Practice is not. It docs not claim to be a comprehensive account of current good practice: nor does it seek to provide a set of prescriptions or strategies for others to copy. Rather it seeks to provide a wealth of detailed description for individual teachers to reflect on and use to improve their practice. The review does not make its own recommendations for good practice. Rather it aims to characterize good practice by reporting the views of others. The aim was to look at ***deaf*** children in general with the word ***deaf*** used to signify the full range of hearing loss. In the event, most of the case-study material collected related to children with more severe degrees of hearing loss rather than those with mild or moderate deafness.

Methodology

Phase One

Respondents were invited to complete a two-part questionnaire. Part one asked respondents to nominate a school, service, college or individual teacher as an example of good practice and to state for which aspects of work the nomination was made. A tick list of suggested aspects of work was included both as a prompt and for ease of response. This list was drawn from the research team's wide research and teaching experience across the range of educational provision for ***deaf*** children as well as a number of key texts (Wood et al., 1986; Webster & Wood, 1989; Luetke-Stahlman & Luckner, 1991; Watson, 1992; McCrackon & Laoide-Kemp, 1997; Gregory et al., 1998; Powers et al., 1998). The tick-list was designed to be relevant to all phases of education, to all placements and all communication approaches, making reference to non-academic as well as academic concerns. Part two of the questionnaire asked for more general views on good practice as well as views on the most important aims of ***deaf*** education. The questionnaire was worded carefully to make it accessible to as wide an audience as possible.

The questionnaire was distributed to parents, teachers, lecturers, ***deaf*** adults, speech and language therapists, educational psychologists, and ***deaf*** organizations. Most questionnaires were sent as flyers in magazines, distributed at conferences or sent individually. The aim was not to obtain a randomised sample of returns but rather to reach as many people as possible. There were 628 replies to the questionnaire with the largest number of responses coming from parents. The relational database management system Microsoft Access was used to sort the nominated schools by establishment type and to categorise aspects of work for which nominations were made.

Phase Two

From the Phase One nominations, sites of good practice covering a range of educational approaches and placement were chosen. The approach taken was illuminative case study based on selective sampling. The case studies were selected to cover a range of views of what constitutes good practice according to the following criteria:

- the need to reflect the range of provision made for deaf pupils regarding educational placement and language and communication approach;
- the need to ensure that there were nominations from different groups(parents, teachers, etc.);
- the need to reflect the range of provision made for ***deaf*** pupils regarding educational placement and language and communication approach;
- the need to include a wide range of different aspects of work (or topics).

According to the criteria for selection not all the establishments strongly nominated were chosen.

Furthermore, in the ones that were chosen the aspects of work selected for investigation were never the only ones for which the establishment was nominated. While aiming to investigate each area of work at least two or three times it was also decided to restrict the number of aspects of work investigated in anyone case study to allow greater depth. In selecting case studies the research team did not include or reject any recommendation on the basis of its own experiences or refer to OfSTED reports. We-think it a strength of this project that it was not the 'experts' making the choices of what is 'good', rather it was based on the views of practitioners.

Each of the 15 case studies was conducted over 1-3 days depending on the number of aspects of work to be investigated. Multiple sources of evidence were used including observation, documentary analysis and interviews (the main research method). Views were sought from a wide range of participants including head teachers of schools, heads of services, ToDs, parents, present pupils, learning support assistants, teachers in mainstream schools, educational audiologists and educational psychologists.

Schedules for interviews and classroom observation were devised, each comprising a short list of key issues relating to a particular theme. The schedules were used in a semi-structured way where on some occasions questions or items were omitted or others added. This approach allowed interesting points to be followed up immediately. The main interest was to establish participants' perceptions of effective work and crucial issues, and where possible, for them to provide examples. In compiling these schedules the research team drew on its wide experience in training ToDs. A few of the items from the interview schedule on 'Supporting ***Deaf*** Pupils in Mainstream Schools' are given in Table I.

Identifying Major Themes

The aim was to report under a number of themes or topics but rather than choosing these topics at the outset they were allowed to emerge from the research itself. This open approach has been described as ‘naturalistic enquiry’ (Robson, 1993, p. 60) and was similar to that taken by Clark et al. (1995) in their investigation into innovatory provision for pupils with special educational needs in mainstream schools.

Findings on Supporting *Deaf* Pupils in Mainstream Schools

Significant findings on the theme of 'supporting ***deaf*** pupils in mainstream schools' are discussed here under six sub-headings.

Two Contrasting Approaches

The study observed two very different approaches taken by services (i.e. LEA teams of peripatetic ToDs) to supporting ***deaf*** pupils in mainstream schools. The other approaches observed fall somewhere between these two.

In the first approach, seen in one service for ***deaf*** children, the emphasis is on ToDs working directly with ***deaf*** pupils in tutorial sessions, that is outside the mainstream class. This service believes that pupils need intensive language teaching which can only be achieved in a withdrawal situation where there are good listening conditions, low levels of distraction and the greater possibility of high level on-task engagement. The main features of this approach are:

- the withdrawal of pupils for tutorial time on a one-to-one basis predominates;
- ToDs provide the support with little use made of learning support assistants (LSAs);
- the main aim is to develop language, literacy and spoken communication skills;

- a second aim is to prepare pupils for full access to the curriculum by pre-tutoring and preparation for mainstream lessons;
- time spent unsupported in the mainstream class is seen as developing pupils' independence.

This model of support, linked to indirect support provided through in-service training to schools, is considered by the service to be empowering for the mainstream teachers and to maintain the important link between pupil and class teacher without the mediation of a third party. However, the approach is not a rigid one so that where there is a particular need for in-class support, for example some form of practical work, the ToD would arrange to be alongside the pupil in the classroom.

The second contrasting approach, seen in another service, has the following features:

- direct support is given by LSAs and maintain teachers;
- ToDs spend almost all their time in an advisory role providing indirect support to mainstream teachers and directing the work of LSAs;
- in-service training for mainstream staff is given special emphasis.

In this service one key function of the advisory ToD is to observe pupils in mainstream classes, noting on a checklist aspects pertinent to a pupil's ability to follow communication. The checklist focuses on the pupil's ability to access both the teacher and other classmates. Use of audiological equipment is also monitored. The advisory teacher uses the checklist as a basis for discussion with the mainstream teacher after the lesson and in some instances a tick list of 'recommendations' is sometimes left.

The two models of support described here differ essentially in the relative emphasis given to direct as opposed to indirect support from ToDs. It is probably true that in recent years there has been a general shift towards ToDs taking on a more advisory role, although from our visits it would appear that the second approach described here is unusual and that most ToDs provide at least some direct support to pupils.

It is important to note that we found no evidence that either of these two very different approaches is better than the other.

Aspects of Direct Support

The general findings concerning direct support were:

- ToDs appear to exercise considerable autonomy over the nature of direst support offered to pupils;

- nearly all ***deaf*** pupils are taught separately from the mainstream class, either by ToDs or LSAs for some of the time;

- arrangements are flexible and are constantly under review;

- withdrawal time is used in a variety of ways;

- the careful planning of withdrawal sessions is stressed;

- where is widespread use of “reverse integration” (see later)

Very few pupils were found to be fully included in mainstream classes (although, as noted earlier, most of the children seen were either severely or profoundly ***deaf)***. However, we came across no examples where ***deaf*** children were taught as a separate class in a mainstream school. The need for flexibility was mentioned by several people. One secondary unit operated a 'reserve timetable': if a pupil did not require the timetabled support, the supporting teacher offered help to one that did need it. Withdrawal for tuition was used in a number of ways; to develop pupils' skills in language, literacy and speech and their skills in listening and social interaction; as an opportunity for reinforcement and consolidation of learning, and for pre-tutoring and preparation; and to develop study skills rather than concentrating on the content of the particular lesson.

The research teams saw several examples, in primary schools, of 'reverse integration'; that is a group of heating children withdrawn from their mainstream class to work with one or more ***deaf*** children, and normally taught by the ToD or sometimes the LSA. Potential benefits of such arrangements (compared with providing support in the mainstream class) include:

- the acoustic conditions should be better;
- speech reading should be easier(because of smaller numbers and better seating)
- teaching is by a person trained to teach ***deaf*** children and familiar with the ***deaf*** child;
- with smaller numbers it is easier to pace the lesson appropriately for ail pupils;
- all the pupils have more opportunity to contribute to discussion;
- ***deaf*** pupils have more opportunity to succeed(with benefits to their self-esteem and motivation).

Reverse integration is often used effectively but it is only one among several approaches and clearly has its limitations. In some subjects the ToD or LSA will not have the subject specialist knowledge required, in others the necessary equipment will not be available. Undoubtedly there are also many cases where ***deaf*** children are achieving well in the mainstream class and enjoy and benefit from the challenge of the large group. Also, many ToDs will still want opportunities for intensive one-to-one or small group sessions with ***deaf*** pupils.

Joint Planning

The importance of regular planning meetings between support and mainstream teachers has been reported many times in the literature (e.g. Monkman & Baskind, 1998; Fletcher-Campbell & Cullen, 2000). In our case studies strong and increasing emphasis was given to this work.

One ToD said, 'As a service we're coming more and more to realise that you can't carry out our work without liaison time'. Reference was made to the need for 'regular, positive meetings' between the ToD and the class teacher 'with close co-operation between both parties' and, where decisions are made concerning the 'role the ToD will play', 'planning the optimum use of the assistant support' and 'preparing and planning for non-curricular and social events in school'.

In several cases reference was made to the importance of having sessions written into the timetable for regular liaison between ToDs and mainstream teachers, although this is undoubtedly easier to arrange in primary schools where fewer mainstream teachers are involved with each child, and in resourced schools where ToDs are permanently on site. In one primary resource base the meeting between the ToD and the classteacher is written into the timetable for lunchtime or after school each Thursday or Friday. Up to 1 hour is set aside to look at the classteacher's plan for the week. In other schools a weekly session is sometimes timetabled at breaktimes or before school.

Joint planning in secondary schools is often more difficult because of the number of mainstream staff involved. In one service, before the end of the summer term the ToD in the resource base asks the heads of department in the mainstream school for the names of the teachers who will be teaching the ***deaf*** pupils the following year and for schemes of work. Also, 2 weeks prior to each lesson she sends out sheets to each teacher asking for more information about lessons, and worksheets and any tests which will require modification. From this she holds a weekly liaison meeting with the LSAs in which she shares a summary of what she has gleaned and its implications. Concern was sometimes expressed about the amount of time liaison was taking. However, one teacher interviewee did not resent the extra time involved because she thought her planning was more detailed than it used to be and she welcomed the need to be more organised. On other visits ToDs mentioned the importance of being able to offer some 'payback' to mainstream teachers for the additional time they were giving, perhaps in the form of materials useful to other children in the class as well as the deaf child.

Involving Pupils in Decisions about Support Arrangments

Increasing the involvement of pupils themselves is one of the main changes in the draft revised 'Code of Practice on the Identification and Assessment of Pupils with Special Educational Needs' (DfEE, 2000). The latter includes a whole chapter on pupil participation where it states 'school and professionals ... need to ... consult with pupils who need individual support ... to ensure that such support is provided in a timely and sensitive way' (p. 14). The research team encountered several examples of such practices including the following where pupils had negotiated the level and type of support they received:

> In one service the secondary pupils have a say in their own support programmes. They can negotiate the amount of support they receive and, up to a point, the subject(s) they omit from the curriculum in order to receive support--they can elect to have 'support' as one of their curricular options. support teachers and the class teachers rely heavily on the comments and feedback offered by pupils. Pupils are encouraged to take responsibility for their own learning needs from as early an age as possible.

In-service Training for Mainstream Teachers

In-service training for mainstream teachers was commonly mentioned as a strategy for developing indirect support to deaf pupils. The main features noted were:

- in-service training is given to a wide range of audiences including, mainstream staff, ancillary staff, health visitors, parents, and school governors;
- substantial in-service training is normally provided to all staff when a school is about to receive its first ***deaf*** pupil;
- teachers who actually teach a pupil are given more regular and more advanced training;
- training covers a range of topics including, deafness, hearing aids, language, literacy, and social skills;
- all ToDs working in mainstream contexts am expected to have skills in such mainstream support work.

One example illustrates some of these features. In one service for ***deaf*** children, all the teachers am expected as part of their job-description to give in-service training; each member of staff presents a case study at one of the regular team meetings; a wide range of materials is available for use, indexed according, to age group and intended audience; ToDs share the task of reviewing the videos bought by the team; and ToDs produce longitudinal studies of children in video form that are used with new staff.

Possible Dangers in Support Contexts

The interviewees showed awareness of the possible dangers in providing support. Most commonly mentioned was 'over-support': the presence of the 'support teacher' might encourage habits of dependency and passivity on the part of the pupil. In one service a ToD told us, 'We are re-thinking how we support ***deaf*** children at primary level. We may have over-supported them and thought less about independent learning skills'. In one service a 'learning behaviour' section had been introduced into each pupil's individual education plan. This was said to emphasise to LSAs the need not to do the work for the children but rather to encourage them to take responsibility for their own learning. With a support teacher present children can be denied making learning decisions for themselves. Quigley and Kretsehmer (1982) warned of the dangers of promoting 'learned helplessness'. Intensive support in the mainstream class by specially employed helpers or by specialist teachers can be an example of positive discrimination becoming counter productive.

Reported occasionally were the negative feelings of mainstream classteachers towards the ToDs. It appears not uncommon for mainstream teachers to say they think that ToDs have an 'easy job' because they teach very small numbers of pupils and do not appear to have to spend the same time in preparation and marking. Some ToDs identified a need for them to explain their role to mainstream colleagues including explaining much of the unseen work TOOs do, for example, preparing modified texts, monitoring language development, managing heating aids and working closely with parents. Some ToDs stressed the need for ToDs in mainstream schools to be as fully involved in the school as possible, for example through participating in staff meetings, lunchtime duties and extra-curricular events and perhaps undertaking some mainstream teaching.

A third danger, though rarely mentioned, is that ***deaf*** pupils occasionally do not welcome the support offered. The ***deaf*** pupil can view the support teacher as 'baggage' that the young person has to drag round from lesson to lesson. The effect of the extra helper on the pupil's attitude to learning can be to reduce pupil motivation and initiative. This possibility emphasises the need for teachers to evaluate carefully the effect of any support arrangements in ways that include feedback from pupils themselves.

Conclusion

Identifying and characterising effective practice is never straightforward. The approach taken by Powers et al. (1999) was unusual in that the research team did not seek to make its own recommendations. Practitioners in schools and services, named by others as examples of good practice, were invited to describe in their words what they thought was most important in their work. Of course, this approach makes the study open to the criticism that important inspection and research evidence was not considered. However, this is to miss the point. The study does not claim to be either objective or comprehensive in its account of good practice. What it provides is the often-neglected perspective of parents, teachers and others most closely concerned and involved with ***deaf*** children.

This article reports only a small part of the study, namely the findings concerning support in mainstream schools. The wider study has added to understanding across a range of teaching approaches and educational settings. The information collected from interviews, document analysis and observations has provided examples of practice in more detail than previously available and Powers et al. (1999) has been a main source of evidence for the RNID in compiling its recent guidelines for teachers (RNID, 2000a, 2000b, 2000c).

Finally in relation to the research process itself, the research team was in a privileged position in having the time to visit a range of practice and to ask a range of questions outside the more usual OfSTED inspection framework. Additionally, the opportunity to talk to practitioners, parents and ***deaf*** children provided the opportunity to reflect on and discuss a range of perceptions and views. A number of practitioners and parents noted the importance of having such an opportunity to talk in some depth about the issues raised. For some staff working in units and or as peripatetic teachers who appreciate the complexity of ***deaf*** education can feel isolated, this was highly valued. There would appear to be clear implications here for the continuing professional development of ToDs and other teachers in similar roles.

TABLE 1. Some items from the interview schedule ‘Supporting Deaf Pupils in Mainstream Schools’

1. How do you crud your colleagues provide direct support to pupils (i.e. what is the range of support activities)?

   * what strategies do you find have worked well? Can you give examples?
   * do any aspects of the curriculum present particular challenges?

2. How do you and your colleagues provide indirect support to pupils (e.g. advice and in-service training to mainstream teachers, modifying texts, *deaf* awareness to hearing pupils)?

   * in what ways do you find you can be most effective? Can you give examples?

3. In what way do you feel the host school's approach helps (or hinders) your policy of inclusion?

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READING, WRITING AND REHABILITATION

A counselor--let's call him Henry--sends his young deaf customer, John, for a job interview. Henry first calls the firm to make sure it has an opening and will hire a deaf worker. Henry is assured on both counts, so he is surprised when John soon returns, crestfallen. He has been abruptly rejected. Henry phones the personnel officer and is told, "We don't hire wise guys!" Puzzled, Henry asks John for more detail about what happened. John, shy about his speaking ability, handed the interviewer a note on which he innocently wrote, "I want your job."

John's story is apocryphal, though it has survived several repetitions among rehabilitation counselors. A true incident, however, happened to me several years ago. I was invited to lunch at a meat-processing plant, but the personnel officer soon made it clear that my visit was not entirely social: He wanted assistance with a deaf employee. Max was a first-rate meat cutter who knew his job so well that his limited ability to communicate did not impede his work. .. not until the company switched its health insurer. Max created such an uproar in the payroll department that he faced discharge. When I met him, Max's vigorous signing explained the source of his rage: He believed that the change meant he and his family no longer had coverage. It took me about half an hour to convince him that he still had coverage and that, indeed, the new plan provided superior benefits. Once that was established, Max went happily back to work and the company was relieved.

The two anecdotes barely illustrate the role of literacy in rehabilitation. Literacy is more than a fancy term tossed about by academics; it is a significant factor affecting the rehabilitation of all clients, especially those with weak reading and writing skills. Colloquial expressions ("I want your job") and limited ability to decipher print (in Max's case) can severely hamper gaining and retaining employment.

The Achievement of Literacy

The education of deaf students in non-specialized classes (a practice labeled "mainstreaming" or "integration") aims to increase their academic achievement. Has it succeeded? The Annual Survey of "Hearing Impaired Children and Youth (ASH ICY) conducts national testing of deaf students each year in 1987, reading comprehension scores of 17 -year-old deaf and hard-of-hearing students averaged a grade-level of 4.0. Ten years later, the average grade level for this age group fell to 3.9 (Holt et al., 1997).

The decline of 0.1 grade between 1987 and 1997 has only statistical interest. Of practical significance is the lack of improvement in reading ability over the 1 O-year period, in spite of the many efforts and much money which were directed during this time towards increasing literacy. For the general population, such poor reading levels signify illiteracy. To the rehabilitation counselor working with deaf consumers, this low-average reading level cautions against any assumptions about deaf people's literacy.

Deafness and Literacy

Do ASHICY's findings mean hearing loss limits literacy? Or do these results expose inadequate curriculums, lack of teacher competencies, failures to apply new technology, or lack of motivation by educators and/or the deaf students? Probably some combination of these factors can account for the lack of improvement in reading, but the blame cannot rest with hearing loss.

Born-deaf people's first language is a visual, not a spoken, language (Schein & Stewart, 1995). In this country, American Sign Language (ASL) is the basic language on which deaf students must build. The discovery that ASL is a true language and the research that shows how quickly deaf children acquire it demonstrate that a language can be acquired without hearing it (Schein & Stewart, 1995). Other research shows language learning is inherited; it is, as the computer experts say, hard-wired into the organism (Chomsky, 1968; Ratner & Harriss, 1994). So learning a language is not the problem: Learning English is the problem.

Bilingualism

Research on language learning finds that bilingualism need not have a negative effect on acquiring a second language. The research on ASL as a first language finds no evidence "that the use of sign language in education interfered with the ability to develop a speech recoding strategy, or that knowledge of American Sign Language (ASL) negatively influenced the acquisition of English skills" (Lichtenstein 1998, p. 80). Data from Denmark, Sweden, Japan, Finland, and Italy also show that deafness does not prevent language learning, neither of the native sign language nor, in printed form, the spoken language (Furlonger & Massa, 1998; Schein & Stewart, 1995; Weisel, 1998).

Since the evidence says English literacy depends upon how American deaf children are taught, not upon their native abilities, rehabilitation professionals must focus their attention on instructional techniques. To become literate in any language, one must first know the language; then, learning to read and write that language amounts to decoding symbols representing it. Some confusion occurs between language learning and literacy. Fluency in a language differs from being able to read or write it.

- Literacy is not an all-or-nothing condition; a person may have more or less linguistic proficiency.
- There are various types of literacy, such as “computer literacy” and “scientific literacy.”

Literacy can be achieved without exceptional talent. Given the opportunity, most people can learn to read and write. Persons with low IQ's can become literate, although it may take them longer to do so.

Chronological age is not an insurmountable barrier: Very young children can, and often do, learn to read before they enter school; and adults can become literate long after they have left school (Apel & Swank, 1999; Fisher, 1998).

Motivation

Willingness to work at learning to read and write is required. When the rehabilitation counselor makes his deaf client understand how crucial literacy may be to obtaining a job, the client will likely undertake remedial instruction with more enthusiasm than before. Not all clients, of course, will respond to that incentive, so the counselor's task remains to motivate the client to study English.

Methods

One researcher argues "that a paradigmatic shift must be undertaken that uses visually based strategies for reading analogous or equivalent to those for hearing individuals" (Grushkin, 1998, p. 179). He insists that this strategy will result in more deaf students becoming successful readers.

A program specifically designed along these lines is Structured Methods In Language Education (SMILE). The author, Enid G. Wolf-Schein (1999), has adapted the Association Method first introduced half a century ago at the Central Institute for the Deaf, St. Louis, Missiouri. In carefully designed, minimal steps, the teacher takes the deaf student through phonics-based instruction from reading to writing. Though the use of a phonics-based approach to teach deaf students is counter intuitive, SMILE has worked so well for teaching English that it now has been translated into Spanish. Its success is consistent with the view that writing is visible speech, which makes the method logical as well as in tune with empirical evidence (DeFrancis, 1989).

The Laurent Clerc Center at Gallaudet University, has an ambitious project to encourage parents to read to their deaf children. As simple as the prescription sounds, the study finds that parents need assistance to implement it. (For an advanced progress report, contact Dr. Linda Delk, GallaudetUniversity, 800 Florida A venue, N.E., Washington, DC 20002, or via e-mail: linda.delk@gallaudt.edu) (See also Paul, 1998, and Lederberg & Everhart, 1998, for other approaches to developing literacy.)

Reading Signs

Wide-ranging research has shown that the manner in which a language is written makes a difference in how easily it is learned (DeFrancis, 1989). Chinese children learn to read their language 10 times faster in Pinyin--an alphabetized version of the Chinese language--than when it is written in the traditional graphemes. Similarly, Turkish is mastered more readily in the Latin alphabet than in Arabic script (DeFrancis, 1989). The Chinese and Turkish experiences should be remembered by anyone who suggests that deaf students would learn English more readily if it were presented in pictographs.

Limiting Bilingualism

Two caveats before adopting bilingualism need to be mentioned. The first is that bilingualism impedes language development when one of the two languages is demeaned. For example, Latino children in Los Angeles schools have more difficulty learning English when their teachers deride their native Spanish (Schein & Stewart, 1995). The second caution is that educators must not take prelingually deaf children's knowledge of ASL for granted because they use it every day. The same educators do not take normally hearing students' knowledge of English for granted, even though they use it daily. Since second language literacy will depend upon the strength with which the first language has been learned, it seems to me that studying ASL should be included in teaching English to deaf students. The greater the first language competence, the better second language learning.

Appraising Literacy

A counselor of deaf clients needs realistic appraisals of their literacy. Using standardized measures, such as the Stanford Achievement Tests, has been criticized because they "penalize" deaf persons. That is true, if they are used to predict their ability to learn or to determine how well they think; but standardized measures indicate where they stand relative to the general population. That, after all, is the measure employers will use. An employer wants to know if the deaf worker will understand printed directions or will make costly errors in operating equipment when instructed verbally; the counselor wants to know if this deaf client will need special assistance to pass a vocational course. These are fair questions, and using inappropriate measures to answer them will only penalize the deaf client.

Use of Interpreters

Few rehabilitation counselors can communicate with a deaf client in sign language. Accordingly, they are required to engage interpreters to aid them in communicating with the client. Finding interpreters and determining their qualifications are not easy tasks. First of all, interpreters tend to be in short supply. That means that too many unqualified people represent themselves as interpreters. One way to avoid them is to insist that the interpreters you use are certified by the Registry of Interpreters for the Deaf or by their state government (Stewart, Schein & Cartwright, 1998).

Once an interpreter is engaged, the counselor must become familiar with how to use the interpreter. All remarks should be addressed to the client. To facilitate that arrangement, the interpreter should be behind the counselor. In that way, the deaf person can see both, and the counselor will be looking at the deaf client when speaking. There is much more to using sign language interpreters, such as avoiding ambiguous language and overly rapid speech. Consulting with the interpreter before the client arrives permits arrangements for lighting, placement and discussion of particular problems that might arise. Once the deaf client is present, the certified interpreter will not respond to questions and will sign anything spoken by the counselor. That is why prior consultation is so valuable to a smoothly interpreted interview.

Sending an interpreter with clients for job interviews and providing an interpreter when clients or employers request one are well-justified procedures. Such instances require interpreters who have the requisite education and experience to handle employment situations. The rehabilitation counselor should also contact employers to inform them about the interpreter's role. Some personnel interviewers regard the presence of the interpreter as indicating a substandard employee. That is why some deaf clients occasionally refuse to permit an interpreter to accompany them on an interview. The counselor can clarify the interpreter's functions and assure the employer that interpreters will not be necessary to the deaf employee's routine duties.

However, there are situations where a deaf employee may need an interpreter to perform routine duties. For instance, a deaf engineer serving as part of a working group may find an interpreter helpful during the group's meetings. In such circumstances, the deaf person who is a skilled lipreader will still be unable to function well, because following the conversation as it moves rapidly from speaker to speaker will sometimes be difficult or impossible. Advising the employer of such added expenses in advance will enable all parties to make an intelligent employment decision. For a fuller discussion of interpreters in rehabilitation, see Stewart, et al. (1998).

Summary Abstract

As rehabilitation enters the Information Age, the criticality of literacy looms large. Of all clients, those who

are deaf and hard-of-hearing face the severest obstacles to entering and flourishing in a labor market that so heavily depends upon rapid, accurate communication. To date, the educational system does not appear to have prepared the average deaf student to attain English literacy. Therefore, rehabilitation must undertake ;he unfinished task of preparing its deaf clients for the new millennium. The evidence presented here suggests that this task can be successful and that deaf clients can achieve literacy, but that to do so will demand strong efforts to motivate them and improved methods to teach them.

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By Jerome D. Schein, Ph.D.

Adapted by Ph.D.

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Source: American Rehabilitation, Winter99/2000, Vol. 25 Issue 3, p32, 3p.
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Title: The fine art of communication. (cover story)

Subject(s): SCHOOLS -- Connecticut -- Hartford; DEAF -- Education -- United States; AMERICAN School for the Deaf (Hartford, Conn.)

Source: Teaching PreK-8, Mar96, Vol. 27 Issue 6, p30, 4p, 14c

Author(s): Winarski, Diana L.

Abstract: Presents the program of the American School for the Deaf (ASD) in West Hartford, Connecticut and its sister school Braebum. What ASD intends to provide to the participants of the program; Example of the program's success; Classroom descriptions at ASD; Partnerships in the program. INSET: The sister school year.

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Section: COVER STORY

THE FINE ART OF COMMUNICATION

Two West Hartford, Connecticut, schools prove how most differences are really just similarities in disguise

Topping nearly every school board agenda and headlining mayor newspapers in recent years has been the nine-letter word inclusion .. An issue as controversial as whole language, phonics and ebonies, inclusion remains a reality most school systems must handle.

At the American School for the Deaf in West Hartford, Connecticut, discussions of inclusion and its relatives -- mainstreaming, special needs and socialization -- are obviously the norm. After all, the school's ultimate goal, outside of academic criteria, is to teach students to thrive in a hearing world.

We are not bringing you a story about inclusion. Rather, our visit to ASD and its sister school, Braeburn, a public K-5 school, explores communication and sharing in a diverse community of exceptional learners.

The pieces fall into place. Professional Growth Less than two miles from ASD sits Braeburn School, a school in an upper-middle-class neighborhood. The staff, students and parents in this community seek an education replete with academic and social opportunities. Focusing on the modalities of learning, teachers structure their curricula to capitalize on students' individual learning styles.

Principal Doug Rudig explains that Braeburn's philosophy is to "take positive educational risks" to provide students with an authentic learning environment. Fifth graders run the school store, for example, and second graders operate a mobile snack wagon from which they sell snack food throughout the school.

Though ASD, a pre-K-12 school (we visited only the 98-student pre-K-6 division), has existed in West Hartford for 180 years and Braebum for 40, the neighboring schools joined forces only a few years ago when a local deaf student, whose home school would have been Braeburn, wanted and was deemed able -to join public school classes. His smooth transition and the enthusiastic reception he received by Braebum teachers and students prompted Christine Tabbert, the northeast regional director of the Educational Resource Centers on Deafness (based at ASD), to contact ASD's principal, Jean Joseph, and Braebum's Doug Rudig.

Working together, the three sought community and school board approval to formalize a "sister school" partnership that would allow several ASD students to attend classes, at least on a part-time basis, at Braeburn, and Braebum students to spend time in ASD classes.

"We wanted it to be a reciprocal relationship because we knew our kids could learn at ASD, too," Doug told us. "We wanted to emphasize the commonalities of all kids and still be aware of each one's unique differences." To support this goal, they purposely kept the program guidelines flexible and informal so the relationship could grow in a natural manner.

Since American Sign Language, used and founded at ASD (and what most of us mean when referring generally to "sign"), is based on concepts rather than on word-for-word interpretation of spoken English, Doug hoped the partnership would augment his students' language skills. "We've discovered that 80 percent of all communication is nonverbal; we want to tap into that and enhance it."

By participating in the program, ASD intended to provide its students with the social and interpersonal skills needed beyond the security of the campus's 56 acres. "The concept really took off," Jean Joseph added. "It's grown from one child being part of a new experience to whole classes and staff exchanges."

A model collaboration. A shining example of the program's success is the partnership between Karen Manko's four first graders (they all happen to be girls) at ASD and Gale Yost's 24 first graders at Braebum. Under the umbrella of the sister school relationship, the two classes met in the spring of 1995 to share a poetry lesson and snacks.

"It was magical," Karen related as we sat on desks in her classroom. "We knew there were real possibilities for something beyond just an occasional visit. The kids were so receptive to one another that we wondered why we should narrow our visits to one aspect of learning

"The seeds were planted for an ongoing partnership. Then, over the summer, Gale and I met to layout our individual curriculums -- they were a perfect fit! We spanned the whole continuum from a study of self, to school, community and cultures and found we were doing the same things, the kids had similar abilities and we were definitely on parallel courses."

Bolstered by extremely supportive principals and parents, they were undaunted by logistics. "Once we saw the infinite connections we could make [to satisfy both curriculums], that we could almost move in .together, it became just a scheduling challenge," explained Karen. "We were open to let it go and grow in any direction."

Working with the facts. Since all of the ASD students experience hearing losses that range from mild to profound, each relies on some combination of hearing aids, FM amplification (an auditory training device), sign language and lip reading to communicate. Deaf students also require a very low student-teacher ratio since teachers must be able to attract their attention visually. At ASD, which has both "regular" classes and "deaf with special needs classes" (for students with circumstances such as attention deficit disorder), the largest class contains 1 0 students and the smallest, three.

Other than these differences, classrooms at ASD look exactly like the best we've seen around the world. Vibrant print and art wallpaper classrooms and hallways; desks, tables and chairs form circles; and pillows and couches enhance carpeted reading areas. Granted, it may be a bit quieter in the hallways at ASD, but the underlying buzz of elementary school students at work generates the same excitement.

Naturally, Braeburn teachers and administrators wondered if their students would feel equally comfortable in the ASD environment. As local residents, Braeburn students encounter deaf people in the community on a somewhat regular basis. Some of the public school students participate in Family Swim at ASD during the summer, and most had encountered sign language on television programs such as Sesame Street.

Still, Gale admitted, "At the outset I was worried. Karen encourages her girls to use their hands as well as their voices, and that can be a little scary for a hearing first grader who may not be used to the different sound. But it was amazing -- they were absolutely fine."

"At our first few meetings," Karen offered, "when the kids' knowledge of sign and deafness was limited, they found their own natural ways of communicating. In talking about their sneakers, they'd lift them up and say, 'See, I have a star and a stripe, too!' Despite our planned efforts to teach them the sign for sneaker or how to hand-spell it, they just did it their own way -- and it worked."

Seamless transitions. Social communication has never been a problem, but in an effort to further assimilate, ASD students who attend Braeburn classes at other grade levels on a regular basis usually don't wear their FM systems. Instead, they're each accompanied by a sign language translator.

During the 1995-96 academic year, ASD sent two third graders to Michele Patnode's afternoon science and social studies four times a week. "I simply had to change my management style a little to be sure I didn't carry any morning lessons into the afternoon," she explained, "But other than that, I didn't have to do anything out of the ordinary. I've always taught using a variety of methods to accommodate the different learning styles among my own students." How did her third graders feel about their ASD classmates? "They adapted so well," Michele told us, a few even enrolled in sign language classes on their own time.

How do they make it work? In two visits to these schools and in talking to 10 or 15 teachers, parents and administrators, we've heard nothing but praise for the sister school program.

Next to staff and parent support, Gale and Karen credit the team teaching approach they use to structure their year-long collaboration. Teaching beside one another, they achieve the flexibility necessary for the program's success. Each feels 100 percent at home in the other's classroom, and when a lesson isn't taking the direction they feel it should, they're free to alter their plans on the spur of the moment.

"The kids themselves have given the program the depth and breadth it's achieved," Karen emphasized. "They've embraced the relationship wholeheartedly; they're forming lasting friendships; and they're learning to communicate."

"They've developed an unbelievable bond," agreed Gale. "When we went to the farm, my kids were always in tune with where the ASD kids were, and whether they were having the same experiences. They were all so caring and supportive."

When the students discover similarities -- two happen to have the same birthday -- or if they see one another outside of school, at the park or McDonald's, they talk about it for days. "It's as if each time, they're reinforcing that they really are all the same," Karen explained.

Chris Tabbert, who's universally credited with instigating the sister school concept, says simply, "Everyone sees so many more similarities than differences. It's simply our methods of communication that differ." But, they've proven, not by all that much.

The Sister School Year

Since both schools emphasize literature in all curriculum areas, this became the natural focus for Gale and Karen's year-long collaboration. Using Joan Walsh Anglund's A Child's Year (Western Publishing, 1992) as a theme, they designed their entire program so that during each of their at least bi-monthly visits, they would teach their first graders to sign and recite another "verse" of Anglund's book. As they learned each one, they hung representative ornaments on a small, artificial classroom tree (photo 1).

Then, they continued their joint meeting with an appropriate related lesson (see monthly outline inset). For example, in March, after learning Anglund's verse "March is springtime, bright and blowy," students studied the weather and created "tornadoes" by swirling colored water in plastic bottles (photo 4).

The culmination of the year's project took place in May when all 28 students, their parents and staff from ASD and Braeburn (and Teaching K-8) were invited to a late morning Literature Tea. The first graders performed their interpretation of Anglund's A Child's Year for the guests. This time, they placed their ornaments on a small live evergreen tree (photo 2).

In June, the two classes met for the 27th and final time at a town: park located between the two schools to plant the tree as a permanent symbol of their (photo 3).

September - Introductions; develop and learn name signs
October - Animal unit; joint field trip to farm
November – Thanksgiving; make handmade butter;
December - Holiday celebration; read Polar Express, decorate gingerbread cookies
January – Explore snow; poetry and writing
February - Read Little Mouse's Big Valentine, discuss feelings; pizza lunch
March – Weather lessons; make tornadoes in a bottle
April - Deaf heritage month; cultural learning about
Africa; handmade drums and music exploration
May – Literature Tea celebration; joint presentation of A Child’s Year
June – Tree-planting ceremony; picnic and games

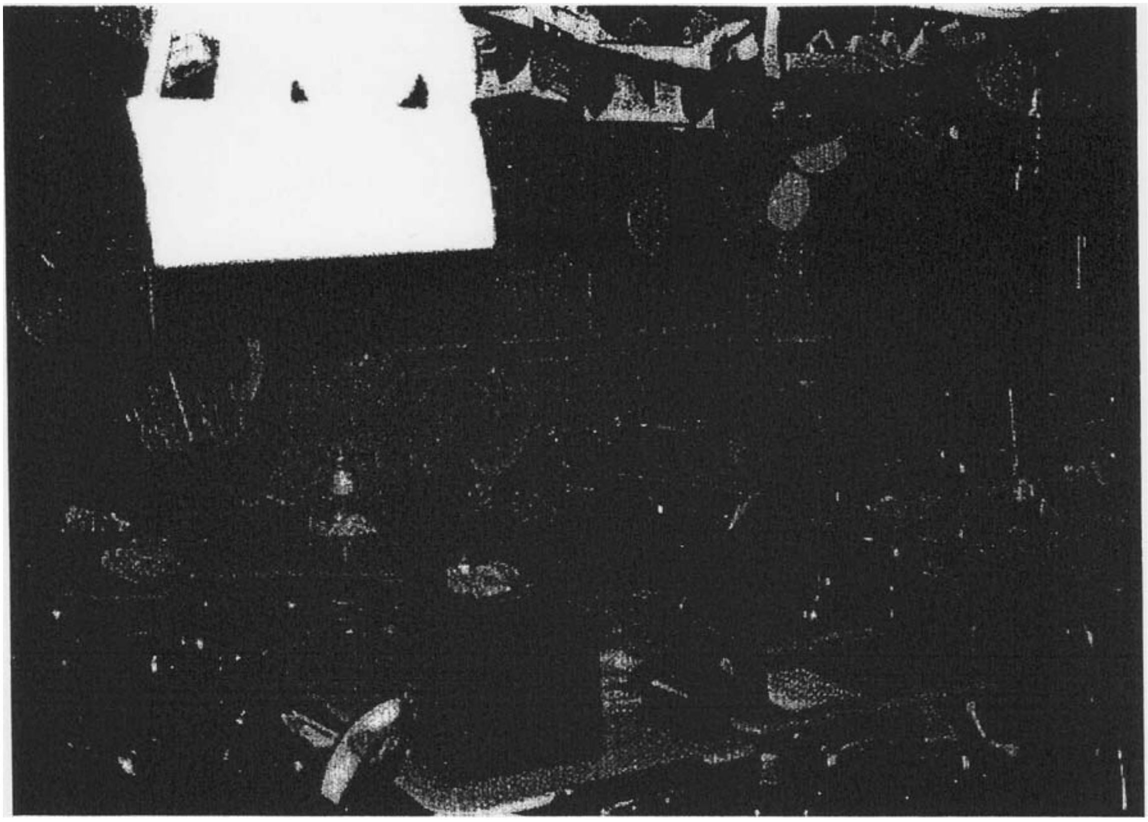
PHOTO (COLOR): ASD divides its 223 students between the Upper School(above) for 7th-12th graders, and the Lower School situated behind it Bracburn's 370 students share a one-story structure (right).

PHOTO (COLOR): With her four students circled around her, Karen Manko (far left) discusses the roles each will play at the Literature Tea.

PHOTO (COLOR): Chris Tabbert (near left) explains ASD's Total Communication philosophy: to address deaf students' educational, social and vocational needs.

PHOTO (COLOR): With flexibility, open communication and a lot of hard work, ASD principal Jean Joseph (left)

PHOTO (COLOR): and Braebum principal Doug Rudig (right) have helped cement the sister school relationship.



Surrounded by the accoutrements of a thriving classroom, Braeburn teacher Gail Yost (left) shares the program's successes with Teaching's Diana Winarski.

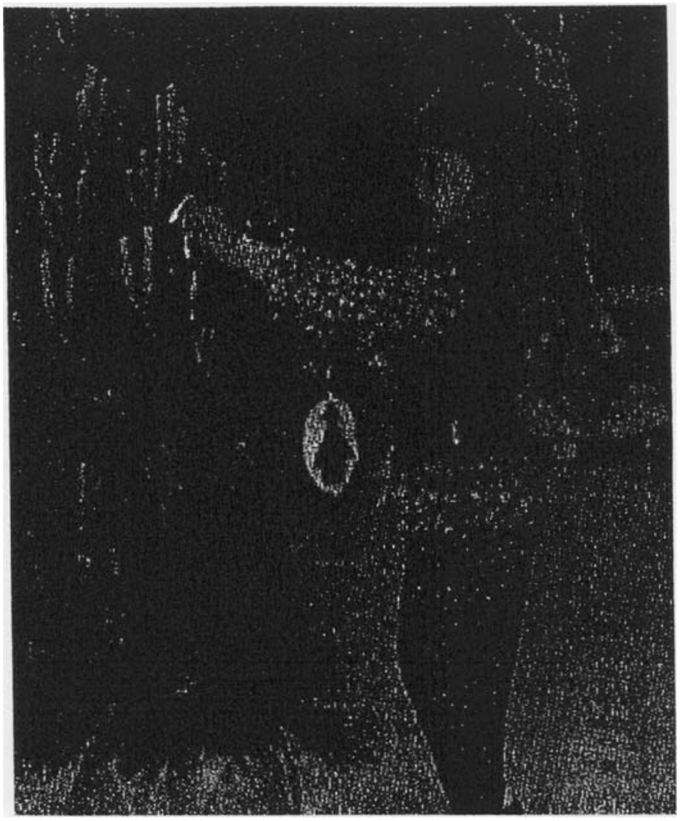
PHOTO (COLOR): A Braebum mother whose four children scurried around her at the Literature Tea spotted Teaching's Diana Winarski (above) and enlisted the use of her empty hands.

PHOTO (COLOR): Their toughest obstacle remains finding drivers with the appropriate certification to transport 24 kids to ASD. Above, Gale Yost helps her students board the bus back to Braebum after the Literature Tea.

PHOTO (COLOR): Most people don't think of music in conjunction with deaf education, but that's precisely where the first ASD-Braebum exchange took place when one boy joined Sue Engle's music class eight years ago. "He was such a bright boy," remembered Sue. "He sang songs, clapped rhythms and even played the saxophone in the band."

PHOTO (COLOR): Students hung representative ornaments on a small, artificial classroom tree

4.



Students place ornaments on a small live green tree

PHOTO (COLOR): Students plant trees as permanent symbol of their unity

PHOTO (COLOR): Students studied the weather and created "tornadoes" by swirling colored water in plastics bottles.

By DIANA L. WINARSKI

Source: Teaching PreK-8, Mar96, Vol. 27 Issue 6, p30, 4p, 14c.
Item Number: 9704045808

Title: New developments in low-bit rate videotelephony for people who are ***deaf***

Subject(s): TELECOMMUNICATIONS devices for the deaf

Source: Journal of Speech, Language & Hearing Research, Dec97, Vol. 40 Issue 6, p1425, 9p

Author(s): Woelders, Wendy W.; Frowein, Han W.; et al

Abstract: Evaluates the picture quality requirements in low-bit rate videotelephony for people who are ***deaf*** Effect of frame rate on speechreading, fingerspelling and sign language; Dependence of speechreading performance on the frame rate; Comparison of speechreading performance with fingerspelling and sign language performances.

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Best Part

NEW DEVELOPMENTS IN LOW-BIT RATE VIDEOTELEPHONY FOR PEOPLE WHO ARE *DEAF*

This study was designed to evaluate the picture quality requirements for three visual communication modes: speechreading, fingerspelling, and sign language. Video recordings of everyday spoken, fingerspelled, and signed sentences were made, and some recordings were processed using a computer simulation of the IBIDEM technology: a videophone based on a novel type of visual sensor. This retina-like sensor, implemented in the camera, has a high resolution in the central part and a degrading resolution in the peripheral part of the picture. Two independent variables were examined: frame rate (10 and 15 frames per second) and spatial resolution (6000 and 8000 pixels per frame). Twenty-four people who were prelingually ***deaf*** participated, 8 in each communication mode. The results showed a marked effect of frame rate on speechreading. Fingerspelling and sign language were not affected by frame rate, and spatial resolution had no effect on any of the three communication modes.

KEY WORDS: videotelephony, picture quality, speechreading, figerspelling, sign language

It is obvious that voice-based telecommunication devices are of limited use to people who are profoundly ***deaf*** or hearing impaired, which may lead to social isolation. Text telephony offers a solution by restoring direct person-to-person contact. However, it is not possible to have a fully interactive conversation, and communication by textphone is slow. Videophones in principle offer a possible solution to overcome these difficulties. Using a videophone gives people who are profoundly ***deaf*** and severely hearing impaired the opportunity to communicate in the same way as they do in face-to-face situations, whether by using speechreading, fingerspelling, or sign language (visual communication modes). In order to design a videophone, which makes it possible to use a visual communication mode, it is important to have knowledge of the process of the visual perception of communication.

Visual perception of communication has two main requirements. The first is sufficient spatial resolution (the number of pixels, i.e., picture elements, per picture) to enable the identification of mouthshapes (speechreading), handshapes (fingerspelling), and signs (sign language). The higher the spatial resolution the better the picture quality. The second requirement is sufficient temporal resolution (i.e., frame rate) to be able to capture the dynamics of spoken, fingerspelled, and signed language. This can be achieved by transmitting the pictures at a relatively high frame rate (the number of updated frames to be presented per second).

Naturally, as high a picture quality as possible is advisable for visual communication, which means high patial resolution and high frame rate. This will result in a large amount of information, expressed in the number of bits per second. The number of bits per second to be transmitted is called the transmission rate. There is, however, a problem: The transmission media available, namely PSTN (Public Switched Telephone Network) and ISDN (Integrated Services Digital Network) telephone lines, have limited bandwidth. This means that there is a limitation to the number of bits per second that can be transmitted; using a PSTN or ISDN telephone line, the transmission rate is only 14.4 or 64 kbit/s, respectively. This implies that the information to be transmitted has to be reduced.

A technique for limiting the information to be transmitted is compression, that is, compressing the digital signal--the video signal is converted to a digital form--on the sending side and decompressing it again on the receiving side. The compression and decompression are performed by a codec (encoder-decoder). There have been a number of studies of different videotelephony systems, using different techniques to limit the information to be transmitted. These studies can be divided into two domains, namely low-bit rate standard PSTN videotelephony and ISDN videotelephony.

In the domain of low-bit rate videotelephony, La (1988) evaluated two videophones, RT43 Videophone and Essex Videophone, as a communication aid for people who are *deaf* He concluded that although the Essex Videophone, possibly running at 9.6 kbit/s, has many drawbacks, it is usable for completely visual dialogues. Disadvantages included a poor overall picture and jerky movements. This is mostly caused by the technique used to achieve data reduction: The picture received from the camera is turned into an "outline cartoon" and only the data describing the cartoon are actually transmitted. Sperling (1981) used another technique to reduce the data to be transmitted: Video sequences of a signer were shown at 60 fps with a raster composed of 9 to 79 lines/frame corresponding to a bandwidth from 1.1 to 86 kHz. The results showed that below 21 kHz the performances of the participants dropped precipitously. Sperling concluded that transmission at ordinary telephone bandwidths (3 kHz) will require more sophisticated picture coding.

ISDN videotelephony has been shown to be an effective medium for people who are hard of hearing and who benefit from speechreading as a supplement to their limited hearing capacities (Frowein, Smoorenburg, Pyfers, & Schinkel, 1991), for sign language communication and speechreading, especially if the speaking rate is not too high (Dopping, 1990), and for people who are prelingually ***deaf*** and who communicate through sign language (Lo, 1990; Marion, 1992). From field trials with people who were ***deaf*** (Frowein et al., 1993), it was also concluded that speechreading via ISDN videotelephony is sufficient for most purposes, but that speechreading in face-to-face communication is easier.

Considering the quality of the currently available ISDN videophones, it is preferable to use an ISDN videophone. But limiting factors include that the pricing is oriented to the business subscriber and that in many rural areas it is still difficult for a private citizen to get an ISDN connection.

Based on the limited number of connections to ISDN and the fact that current techniques to reduce the information lead to much degradation of picture quality (Lo, 1988; Sperling, 1981), a technique should be developed to reduce the information to be transmitted. The technique should preserve the picture quality for visual communication modes, without exceeding a 14.4 k bit/s transmission rate to allow transmission over PSTN telephone lines.

In this study, which is a part of a European TIDE project IBIDEM, a technology to reduce the information to be transmitted has been investigated. A novel type of visual sensor, implemented in a camera, was developed (Ferrari, Nielsen, Questa, & Sandini, 1995). This visual sensor has a spatial resolution modeled after the human retina (i.e., a retina-like sensor). The geometry of the visual sensor has a high resolution in the central part and a degrading resolution in the peripheral part as depicted in Figure 1. As shown in Figure 1, when the spatial resolution is about 8000 pixels per frame, then the pixels are arranged in a series of concentric circles or rings, increasing in size and pixel composition from the center to the periphery, as allows: one circle with one pixel, surrounded by one ring with four pixels, surrounded by two rings with 16 pixels/ring, surrounded by five rings with 32 pixels/ring, surrounded by 10 rings with 64 pixels/ring. In contrast, the peripheral part consists of 56 rings with 128 pixels/ring. Additional information concerning the sensor can be found on the Internet at http://www.imec.be/fuga/fuga18.html

This solution results in a reduction of the number of pixels of the acquired picture (allowing a higher frame rate on standard telephone lines) without degrading the perceptual appearance of the picture. Thus, the imaging sensor that lays the foundation of IBIDEM has the potential to satisfy the temporal and spatial requirements by acquiring pictures with the highest resolution over a limited part of the picture and a lower resolution in the remaining part. This sampling strategy will produce pictures with the smallest number of pixels and highest frame rate permissible for the transmission bandwidth. Work has started to ensure that the images produced by the IBIDEM camera can be processed by H261 and, preferably, H263 codecs, thus ensuring compatibility between the IBIDEM technology and current video coding standards.

In summary, the novelty of this technology is not that less information is transmitted, but the criterion on which the information is selected. Important information, such as the moving head of the speaker (spoken language) or the moving upper body of the speaker (fingerspelled and signed language), will be transmitted with a high resolution. In contrast, less important information, such as the lower part of the body and the surroundings, will be transmitted with a degraded resolution. This differs from previous studies (Lo, 1988; Sperling, 1981) that used data reduction techniques that resulted in a decreased picture quality of the whole picture.

Experiments

Three experiments were carried out, in which the picture quality requirements for three visual communication modes, namely speechreading, fingerspelling, and sign language, were evaluated, using the retina like sensor.

Picture quality parameters that were used to describe these requirements were grey scale resolution, sensor lattice, compression method, image format, frame rate, and spatial resolution. Following subjective assessment, the first three parameters were fixed, ensuring acceptable picture quality. These were an eight-bit grey scale resolution, a square sensor lattice, and a compression ratio of about 15, respectively. The image format was not varied experimentally across conditions as well, but rather the most natural format was chosen for each communication modality. The image format in the speechreading experiment was head only, in the fingerspelling experiment head and shoulders, and in the sign language experiment head and torso.

The picture quality parameters selected for experimental investigation with the participants (all of whom were prelingually ***deaf***) were frame rate and spatial resolution. The frame rate conditions chosen for investigation were 10 fps and 15 fps, because previous research (Frowein et al., 1991) with people who were hearing impaired has shown that speechreading performance below 10 fps becomes quite difficult, although increasing the rate beyond 15 fps does not lead to a significant increase in performance. The two levels of spatial resolution chosen for investigation were 6000 and 8000 pixels per frame. These levels were selected following expert assessment of picture quality for simulations at reduced spatial resolution levels and technical feasibility, respectively. In Figure 2 the 6000 and 8000 pixels per frame images and the control image, which has a normal television quality (S-VHS), are presented.

The two levels of the chosen variables were combined and this resulted in four experimental conditions, namely (A) 10 fps/6000 pixels per frame, (B) 15 fps/6000 pixels per frame, (C) 10 fps/8000 pixels per frame, and (D) 15 fps/8000 pixels per frame.

In an attempt to reduce potential order effects the order of the experimental conditions (A up to D) was varied according to a partial Latin-square design. To investigate the four experimental conditions four different sentence lists were used. The order of these sentence lists (1 up to 4) was also systematically varied according to a partial Latin-square design to reduce potential list effects. Then the sentence lists were combined with the four experimental conditions.

Method

Material

In the speechreading and fingerspelling experiments nine lists of 13 phonetically balanced Dutch "everyday" sentences of 8-9 syllables each were used (Breeuwer, 1985), which were based on the Plomp- en Mimpen (PM) sentence lists (Plomp & Mimpen, 1979). Each list consisted of about 110 syllables. Six of the nine lists, namely PM lists 1, 3, 4, 6, 7, and 10, were also equivalent with regard to their visual difficulty (Frowein et al., 1991). Examples of the speechreading and fingerspelling materials are: "The car has a flat tire"; "The green apples tasted very sour"; "I have bought new shoes"; "He could not find the hammer."

In the sign language experiment 9, equally difficult lists, based on syntactical difficulty, of 13 Dutch "everyday" sentences of 3-6 signs were made in cooperation with two very skilled signers. Each list consisted of about 50 signs, and included non-manual features, such as speech and facial expression. Again the lists were based on the PM lists. Examples of the sign language material are: "HOUSE BEHIND DITCH" (There is a ditch behind the house); "ARM index YOUR FRACTURED yes-nodding" (Your arm IS fractured). In these examples each gloss is printed in capitals and "index" means pointing at someone or something.

The nine lists were divided into three categories: practice, experiment, and control lists.

Video Recordings of the Material

The procedure for making video recordings of the sentences was the same in all three experiments. The rate of the message production of the speaker and the signer was a normal and fluent conversational rate. The fingerspeller, who spelled each letter of every word, simultaneously produced the words. The fingerspelling rate was about four letters/s, which is a normal rate (Sperling, 1981). The speaker, fingerspeller, and signer were separately recorded in the studio of the Instituut voor Doven with an S-VHS videorecorder and a color camera (Sony Hyper HAD, CA-537p).

An observation timer was used, giving sound signals at fixed time intervals. The time intervals were 10s, 16 sand 15 s in the speechreading, fingerspelling, and sign language experiment, respectively. Before each sentence, two signals were used. The first triggered a light flash that was used in the speechreading experiment for synchronization of the unprocessed audio signal with the processed video signal (see next section). This light could also serve as a cue for the participants to alert them that the next sentence would be presented within a few seconds. To that end it had been recorded by a second camera and was projected picture-in-picture underneath the chin of the speaker (see black squares in Figure 2). The second signal was used as a warning signal to pronounce, fingerspell, or sign the next sentence.

Processing of the Material

Not all lists were processed. The experiment lists were processed for all four experimental conditions: A, B, C, and D. This meant that there were 16 different combinations. Also, two practice lists were processed, so that the participants knew which four conditions to expect and became familiar with these different conditions.

The processing of the material was divided into three main stages. In the first one, sequences were acquired from the videotape using a VDS 7001 Eidobrain workstation for digitizing each frame at a resolution of 256 times 256 pixels. In the second stage, the digitized square images, stored in the workstation memory, were processed using two spatial resolutions, namely 6000 and 8000 pixels per frame. The processing included the resampling of the images from a square resolution to a log-polar (i.e., retina-like) resolution. This was achieved by superimposing the square images with the correct log-polar resolutions (i.e., 6000 and 8000 pixels per frame). In order to get the log-polar images, the pixels from the square images that fell inside a log-polar pixel window were averaged. This corresponds to an integration phase similar to the integration that takes place on a pixel in a camera sensor. The resulting images were stored into the RAM memory of the workstation. In the third stage, the processed sequences were played back and recorded on videotapes at two different frame rates, 10 and 15 fps.

The processed lists were in black and white, whereas the unprocessed lists were in color. In Table I the distribution of the lists is shown.

Participants

Three different groups of 8 people participated, one in each experiment. All participants were prelingually ***deaf*** and very skilled in the communication mode in which they were tested. They all had good language competence and adequate vision to complete the task.

The participants in the speechreading experiment were given not only visual, but also auditory information during the experiment. Seven of them used a monaural hearing aid. The 8 participants had a Fletcher Index between 100 and 120 dB HL. The Fletcher Index is the mean hearing loss in dB HL at 500, 1000, and 2000 Hz. In Table 2 the characteristics of the participants are shown.

Procedure

The experiments took place in a quiet room with closed curtains and one fluorescent lamp in the middle of the room. All participants were tested individually in one session and by the same test leader ("TLl "). In the fingerspelling and sign language experiments there was a second test leader ("TL2"), who was an expert in fingerspelling and sign language, respectively.

The instruction for the participant was in print and the test leader answered questions if something was not clear.

In the fingerspelling and sign language experiments the sentences were presented only optically, whereas in the speechreading experiment the sentences were presented both optically and acoustically, at 70 dB SPL measured at one meter, to approximate typical conversational speech levels. Participants who reported wearing a hearing aid regularly were asked to use their aid during the experiment.

Videotapes were played on an S-VHS videorecorder. The participant was seated in front of a 14-inch TV monitor at a distance of one meter. The adjustments of the monitor, such as contrast and brightness, were the same for all participants. A camera (Canon Canovision E850 Hi) was trained on each participant to film responses. The camera was connected to a second TV monitor. TLl was seated on the participant's right, out of the direct line of vision. In the fingerspelling and sign language experiments TL2 was seated behind the participant. He watched the second monitor to see the responses of the participant.

The order of the lists was (a) three practice lists, first the unprocessed and then the two processed, (b) one control list, (c) four experiment lists, and (d) one control list.

The participants had to repeat each sentence immediately after presentation. They were instructed to repeat any word they might have seen, even if they were not convinced of that word, or if they did not see the complete sentence, or if the sentence did not seem to make any sense. After completing each list, the participants took a short break. The session lasted approximately 45 minutes.

Scoring and Data Analysis

For each participant a form was made that consisted of a page on which the personal data of the participant could be written and one page for every list to be presented, in the order of presentation for that particular participant.

Video recordings of all the experiments were made, so that the test leader was able to verify the responses of the participants, if necessary.

In the speechreading experiment the participants repeated each sentence orally and the test leader underlined on a score sheet each syllable that had been correctly repeated. In the fingerspelling and sign language experiments the participants repeated each sentence by fingerspelling (sometimes in combination with usually rather indistinct speaking) and sign language, respectively. TL2 spoke aloud the responses he saw on the second monitor and TLl underlined on the score sheet each fingerspelled syllable or sign of the sentence that had been correctly repeated.

The scoring procedure was very strict. The response had to match the signal exactly; equivalent words or signs were not counted as correct.

After a session, the number of syllables or signs correctly repeated per list was counted. The practice lists were not scored. The first three sentences of the experiment lists and the control lists were considered as practice sentences and were not scored. Because of the slight variations in the total number of syllables or signs per list, the raw sums per list were converted to percentages of correctly repeated syllables or signs per list. The average of the two unprocessed control lists was calculated and served as a reference.

Data analysis was carried out separately in the three communication modes. All analyses were done using the statistical program SPSS for Windows. Arc-sine transformation was used to convert all the percentages to arcsine units. The statistical tests used were one-way Analyses of Variance and post hoc comparisons to compare the five conditions: the control condition and the four experimental conditions. Two-way Analyses of Variance was carried out to compare the two independent variables: spatial resolution and frame rate.

Results

In Table 3 the descriptive statistics for the conditions are presented; for each condition, the mean correct score, the median correct score, and the standard deviation are given. As shown in Table 3, in each separate experiment the mean correct scores and the median correct scores were similar. In Figure 3 the results of the three experiments are graphically presented; in the speechreading experiment there was much variation in the mean, minimum, and maximum correct scores for the five conditions, whereas in the fingerspelling and the sign language experiments there was less variation.

One-way Analyses of Variance showed that the difference between the mean performance scores for the five different conditions (the control condition and the four experimental conditions) was significant in the speechreading experiment, $F(4, 43) = 21.09$, $P < .01$, and in the sign language experiment, $F(4, 43) = 5.09$,) < .01. Mean performance scores were not significant in the fingerspelling experiment, $F(4, 43) = .49$, $P > .05$. Concerning the speechreading experiment, the Tukey-HSD post hoc test ($p < .05$) showed that mean performance scores were significantly higher for the control condition compared to the four experimental conditions, and that mean performance scores for the two 10 fps conditions were significantly less than those for the two 15 fps conditions. With respect to the sign language experiment, the Tukey-HSD post hoc test ($p < .05$) showed that mean performance scores were significantly higher for the control condition compared to the 10 fps conditions. However, mean performance scores across the two fps conditions were similar.

The effect of the independent variables (spatial resolution and frame rate) was determined by carrying out a two-way Analysis of Variance. Two-way Analysis of Variance, as can be seen in Table 4, showed that (a) the effect of spatial resolution was not significant in all three experiments, (b) the effect of frame rate was significant only in the speechreading experiment, $F(l, 28) = 31.47$, $P < .01$, and (c) there was no significant interaction between spatial resolution and frame rate in all three experiments.

In the fingerspelling and sign language experiments the participants were positive about both the unprocessed and processed sentences. Surprisingly, some of the participants in the sign language experiment preferred the processed sentences; they said that these were easier to understand because they had to pay more attention by focusing on the clear central part of the processed images. In the speechreading experiment the participants were less positive; they said that the degrading spatial resolution in the periphery was distracting and that it was fatiguing to understand the speaker.

Discussion

The Speechreading Experiment

The results of the control condition agree with the comparable study of IJsse1dijk and Elsendoom (1993) with participants who were profoundly hearing impaired; IJsseldijk and Elsendoom (1993) also found average correct scores on speechreading of sentences of about 50%. However, in some studies the correct scores were about 30% (Clouser, 1976; IJsseldijk, 1992). In other studies participants scored about 70% (Fransen et aI., 1992). We think that this may be due to the various levels of acoustical information that are presented to the participants in the different studies, because there is a positive effect of the addition of acoustical information on speechreading performance (Brooks, Hudson, & Reisberg, 1981). Clouser (1976) and IJsseldijk (1992) presented only optical information, whereas Fransen et al. (1992), who used stimulus material that was comparable to our material, presented optical and acoustical information. In the study of Fransen et al. (1992) the participants who were hearing impaired scored about 45% on the audio-only condition.

The results of the experimental conditions clearly indicate the importance of frame rate, which was 10 or 15 fps, rather than spatial resolution, which was 6000 or 8000 pixels per frame, as a critical variable for speech readability. Of course, this only applies to the limited range of spatial resolutions considered in this study. The 15 fps conditions lead to approximately 30% degradation in speechreading performance compared to the normal television quality (the control condition). This is in contrast to the results of another videotelephony experiment in which PM lists were used as stimulus material (Frowein et al., 1991). Frowein et al. (1991) showed that speechreading performance improved as the frame rate was increased to 15 fps and that a further increase in frame rate did not result in further improvement of speechreading performance. The significant difference between the 15 fps conditions and the control condition in our experiment may be due to the fact that only the control condition was in color, whereas the experimental conditions were black and white, which might diminish the contrasts in the mouth. Secondly, only the control condition had a high resolution all over the screen, whereas the experimental conditions had a high resolution in the middle and a lower resolution in the periphery of the screen, which could also have had an effect on the speechreading performance. This corresponded with the comments of the participants; they were negative about the lack of mimic (facial expression), which was caused by the degrading resolution in the periphery. Finally, it may be due to the fact that in our experiment the participants were ***deaf***, whereas in Frowein's study the participants were hearing-impaired adults with an average hearing loss of 72 dB. A good spatial resolution might be more important for users who are ***deaf***, and benefit only minimally from the audio signal. Further research is needed in this area.

Finally, it has to be mentioned that in our study speechreading meant lipreading with the hearing aid on. If the group of participants had been composed entirely of speechreaders (vision-only), this might have resulted in larger performance differences between the 25 fps (control) and 15 fps or 10 fps conditions.

The Fingerspelling Experiment

The results correspond with other studies of the reception of fingerspelled sentences, which report average correct scores of 80% to 90%, with participants who were ***deaf*** and material that was comparable to our material (Reed, Delhome, Durlach, & Fischer, 1990).

It can be concluded that the experimental conditions give approximately the same average correct scores as the control condition (i.e., the normal television quality). As can be seen in Figure 3, the range in the experimental conditions is wider than the range in the control condition. A possible explanation for the fact that the decreasing frame rate does not affect the average correct scores has to do with the rate of fingerspelling. The average rate of fingerspelling in our experiment is approximately four letters/s, which is a normal rate (Sperling, 1981). Using a frame rate of 10 to 15 fps would be high enough to transmit fingerspelling with a rate of four letters/s without causing data reduction.

The Sign Language Experiment

The results of the control condition correspond with the study of the reception of signed sentences by Sperling (1981), who also found average correct scores of 80% to 100%, with participants who were ***deaf*** and material that was comparable to our material.

It can be concluded that the 15 fps conditions give approximately the same results as the control condition (i.e., the normal television quality).

The conditions that differed significantly from the control condition were the 10 fps conditions. Using a temporal resolution of 10 fps apparently causes a reduction of information of the signed sentence. This agrees with the study of Whybray (1991) who found that when using a frame rate of 6 to 12 fps the signer has to sign more slowly and deliberately than normal to prevent loss of information.

Finally, as can be seen in Figure 3, remarkably the lowest correct score in the 10 fps/6000 pixels per frame condition is about 90%. Thus, the mentioned significant effect might not be of practical importance.

Conclusions

Results from the three experiments support the conclusion that the IBIDEM technology, the retina-like sensor, is appropriate for the various forms of visual communication modes, namely speechreading, fingerspelling, and sign language, used by people who are ***deaf***.

With regard to the spatial resolution, there was no significant difference between the 6000 and the 8000 pixels per frame conditions. This means that a spatial resolution of 6000 pixels per frame would be sufficient.

Frame rate did have a significant effect on speechreading, but did not have a significant effect on fingerspelling and sign language. In view of the higher scores on the 15 fps conditions than on the 10 fps conditions in the speechreading experiment, it may be concluded that a frame rate of at least 15 fps would be advisable.

Comparing the three experiments, which should be done with great care because of substantial differences, the following two conclusions may be drawn:

1. Speechreading performance is dependent on the frame rate. An explanation for the significant effect of frame rate is that the rate of fingerspelling, even with skilled fingerspellers, is much slower than spoken or signed language (Sperling, 1981). This means that there are fewer phonetic elements per second during fingerspelling than during spoken or signed language. Using a frame rate of 10 fps, for example, will cause no data reduction during fingerspelling, because the normal rate of fingerspeUing is about four letters/so There will be data reduction during spoken language, however, because the normal rate is faster than 10 phonemes/so

2. Speechreading performance is lower than the fingerspelling and sign language performances. This could have been expected. It is a fact that there is less redundant information in the optical signal for the speechreader than in the signals for perceivers of fingerspelling and sign language. In fingerspelling, each letter has a unique handshape, but there is not a one-to-one correspondence between speech sounds and mouthshape. For example: in Dutch there are 26 different handshapes (the 26 letters of the alphabet), whereas there are only 8 to 9 visemes (i.e., groups of visually indiscriminable phonemes) (van Son, Huiskamp, Bosman, & Smoorenburg, 1994). A viseme is, for example, /b/, /m/, /p/. This means that the speechreader must derive the difference between, for example, /baed/ versus /paed/ from the contextual information (so-called top-down processing). Add to this that the visible differences between visemes are relatively small in comparison to the differences between handshapes or signs. Although there is a lower performance on speechreading than on fingerspelling and sign language, it is a fact that many people who are ***deaf*** and hearing impaired, and the majority of the people with normal hearing, communicate by spoken language. This means that in developing a videophone, the minimal demands for picture quality have to provide the dynamic information and resolution necessary to communicate through speechreading.

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Table 1. Distribution of the lists of sentences in the speechreading, fingerspelling and sign language experiments.

	Lists of sentences			
	Practice		Experiment	Control
Communication mode	NP	P	P	NP
Speechreading	PM 2	PM 15+16	PM 4+6+7+10	PM 1+3

Fingerspelling	PM 2	PM 15+16	PM4+6+7+10	PM 1+3
Sign language	5	6+7	1+2+3+4	8+9

Note. NP= not processed; P = processed; PM = Plomp- and Mimpen sentence list.

Table 2. Description of the speechreading, fingerspelling, and sign language participants.

Legend for Chart:

A - Communication mode
B - n
C - Sex, M
D - Sex, F
E - Age (years), mean
F - Age (years), range
G - Communication mode in everyday communication

A	B	C	D	E	F	G
Speechreading	8	6	2	27	17-44	Speaking and speechreading
Fingerspelling	8	7	1	18	16-20	Fingerspelling and some speaking and speechreading
Sign language	8	2	6	38	26-50	Sign language and speaking and speechreading

Note. n= number of participants; M= Male; F= Female

Table 3. Descriptive statistics for the conditions.

Legend for Chart:

A - Condition
B - Speechreading, M
C - Speechreading, Mdn
D - Speechreading, SD
E - Fingerspelling, M
F - Fingerspelling, Mdn
G - Fingerspelling, SD
H - Sign language, M
I - Sign language, Mdn
J - Sign language, SD

A	B	C	D
	E	F	G
	H	I	J
10 FPS/6K	19.92	18.29	5.87
PIX	84.90	87.80	13.75
	92.61	92.00	4.12

10 fps/8k pix	17.29	16.10	4.31
	82.13	83.64	11.68
	94.51	93.78	3.56
15 fps/6k pix	35.92	33.33	12.16
	85.53	88.37	12.69
	96.51	97.30	2.21
15 fps/8k pix	38.97	38.86	11.98
	85.67	88.83	11.41
	96.78	97.41	1. 85
25 fps/s-vhs	54.81	53.55	12.93
	87.80	91. 72	9.58
	98.51	98.69	1.12

Note. fps= number of frames per second; pix = number of pixels per frame

Table 4. Two-way analysis of variance for independent variables.

Legend for Chart:

A - Source of variation
B - df
C - Speechreading, MS
D - Speechreading, F
E - Fingerspelling, MS
F - Fingerspelling, F
G - Sign Language, MS
H - Sign Language, F

A	E	B	C	D
		F	G	H
Spatial	.01	1	.00	0.01
resolution(S)		0.20	.01	0.40
Frame	.02	1	.32	31.47 [a]
Rate(FR)		0.38	.07	3.59
S x FR	.01	1	.01	0.71
		0.14	.00	0.21
Residual	.05	28	.01	-
		-	.02	-

ap<.001.

5.

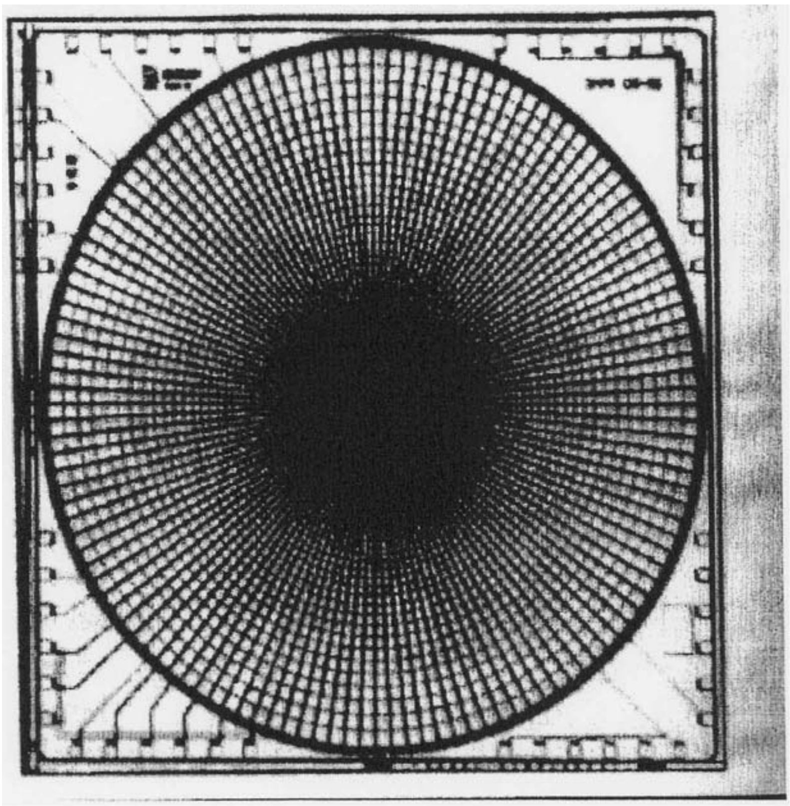

Figure 1. Image of the retina-like sensor with 8192 pixels. This sensor, implemented in a camera, has a high resolution in the central part and a degrading resolution in the peripheral visual part (from http://www.imec.be/fuga/fuga.18.html on the Internet).

Figure 2. Images of the conditions. The 6000 and 8000 pixels per frame images are acquired using a computer simulation of the IBIDEM technology: a videophone based on a novel type of retina-like sensor.
The control condition image has a normal television quality (S- VHS).

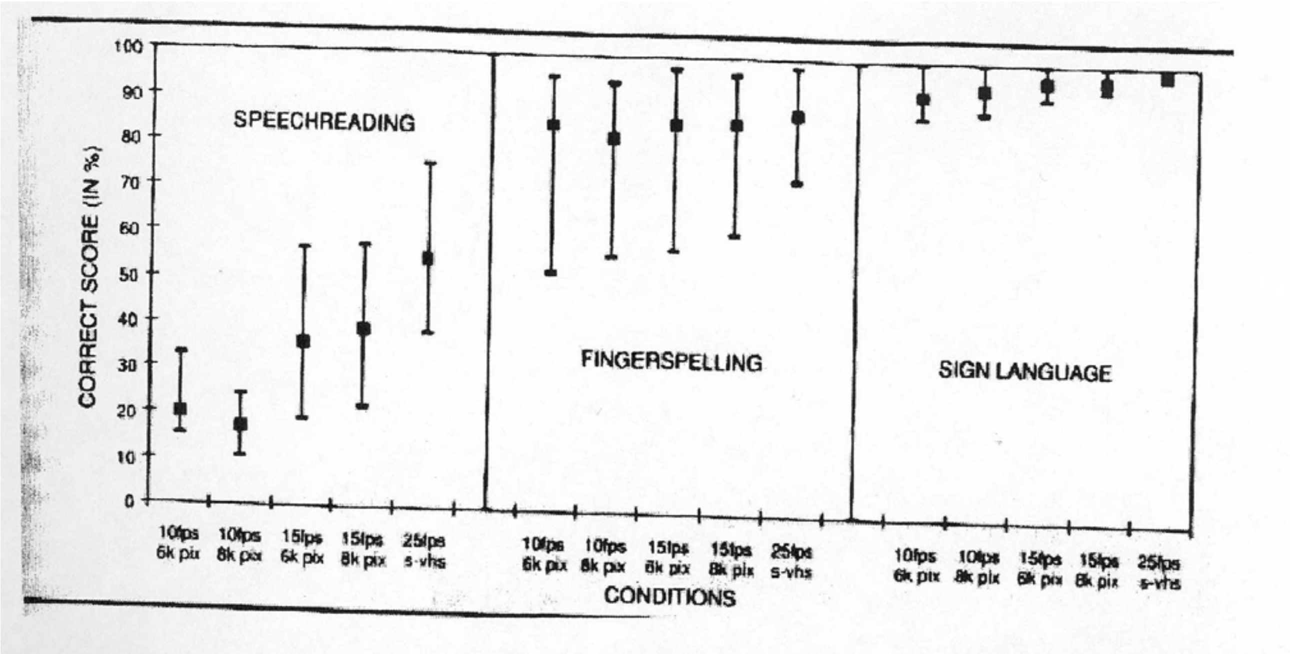

Figure 3. The mean correct scores and the range of the correct scores on the five conditions in the speech reading, fingerspelling, and sign language experiments (N = 8 per experiment). The conditions are expressed in the number of frames per second (ips) and the number of pixels per frame (Pix).

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