Implications of NTID Research for Deaf & Hard-of-Hearing People

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This paper reviews the evidence on critical periods for language acquisition (age[s] after which not everyone can learn a language) and concludes that just as there are critical periods for aspects of spoken languages, so there are critical periods for the acquisition of signed languages, as well as for aspects of the signed and spoken modalities. Critical periods affect the acquisition of language by deaf children, but they also affect the acquisition of sign language by hearing adults such as parents and teachers. The paper itself discusses implications for deaf education, some of which are detailed below.

Implications

Because there is a critical period for the acquisition of sign language, it is imperative that deaf children be exposed to an accessible language as early as possible. That language is likely to be visual since deaf people can’t hear. One cannot expect late learners of sign languages such as parents and teachers to fully master a natural sign language. At the same time, however, expecting children to adapt to varieties of signing that are convenient for adults can cause problems too, such as having to unlearn semantic fields in order to communicate with members of the Deaf community. It is also unrealistic to expect signed versions of English to bear the entire burden of all functions of language (learning, conveying information, modeling grammar, and metalinguistic functions); some of those functions can be handled by contextualized print, such as one finds in television captions.


This research studied deaf students’ performance on memory span and component reading tasks which incorporated processes involved in higher level comprehension. The instruments developed in the study provide the basis for the measurement of functional working memory capacity, vocabulary knowledge, domain-relevant knowledge, and inference abilities. Multiple regression analysis was used to construct models which show the contributions of the independent assessments to reading comprehension ability. Overall, results suggest that working memory capacity operates as a general executive system, as indicated by significant correlations between subjects’ performance on reading and nonreading tasks. Limitations in vocabulary knowledge continue to pose problems in reading for deaf individuals. General or procedural knowledge also plays a part in reading comprehensive processes.

Implications

The findings provide further support to the hypothesis that deaf individuals’ cognitive processes are not different from those of hearing counterparts. Vocabulary and procedural knowledge should receive greater attention in related academic programs of study.

This research examined the ability of deaf and hearing college students to transfer and apply their math computation and problem-solving skills to similar problems presented under different conditions. Four classes of deaf students enrolled in NTID math classes and a comparison group of hearing college students were given math problems to solve that were presented graphically and in word problem format. The problems were matched for similarity and difficulty for the two conditions. The results showed that both the deaf and hearing college students were comparable in their performance to transfer and apply their math skills to solve the varied problem sets within the graphic condition and the first problem set of the math word problems. When comparing performance between the graphic and word conditions, the data show that the hearing college students performed consistently across both conditions. In contrast, deaf students with reading levels at the 9.3 grade level or higher performed significantly better on the more complex and difficult word problems when compared to the deaf students grouped by 8th and 7th grade reading ranges. The higher level deaf reader’s problem solving performance across both the graphic and word problem conditions approximated that of the hearing comparison group. Finally, the problem solving performance of both hearing and deaf college participants was influenced by the increase in problem complexity and difficulty.

Implications

Given their similarity in performance with the graphic problems and the least complex word problems, the results of this study indicate that the deaf college students’ computation and solving skills for these kind of problems are comparable to their hearing peers. Since the computational requirements were the same for both the graphic and word conditions, the deaf students’ decline in performance with the word problem condition cannot be attributed to a lack of math computation and problem solving skills. The generally lower reading skills of deaf college students could likely have hindered their ability to recognize the similarity of the math problems in the word condition to the almost identical problems that they successfully solved in the graphic condition. Not recognizing the similarity of the word problems to the graphic problems would have prevented them from utilizing low-road transfer of skills to solve the problems. Also, the qualitative comments of a number of deaf students in the middle and lower reading levels suggest that a learned avoidance response behavior could very well be another contributing factor to their continuing difficulty with word problems. Strategies for improving transfer in problem solving are recommended and discussed.


This book provides a readable and comprehensive summary of the “state of the art” relating to deaf children’s language, social, and cognitive development. Various chapters consider the causes and types of hearing loss, family dynamics, technological aids for deaf people, educational issues, intelligence, mental health, social development and literacy. Special attention is given to language development (with detailed explanations of alternatives and their implications), and the ways in which it affects educational, social, and personal functioning. Schooling and educational choices are described and discussed in terms of their typical outcomes for deaf children and the implications for both career success and personal fulfillment. Focusing on topics of interest to parents and teachers of deaf children, the book uses facts rather than opinions to describe the implications of childhood hearing loss and the implications of the choices that parents and children will make.
Implications

If parents and teachers are to make appropriate decisions with regard to deaf children, they need to be informed. Although there is a wealth of research evidence available that could assist in guiding those decisions, parents of deaf children often report that getting clear and authoritative information is extremely difficult. More often they are bombarded with anecdotes and biases, while finding it difficult to get facts. This book therefore is intended to provide a comprehensive guide to the choices and controversies faced by parents and educators of deaf children based on available research. At each decision point, the alternatives and their implications are described, together with suggestions for optimizing opportunities for deaf children’s success.


Two experiments examined the problem solving strategies of deaf and hearing students from 7 years to college age in the context of the Twenty Questions game. Overall, deaf children were significantly less likely than hearing peers to “win” the game within Twenty Questions, and problem solving appeared less efficient and less cognitively sophisticated among deaf than hearing students at all ages. Deaf and hearing children who had played the game before were equally likely to use winning strategies. However, inexperienced hearing children typically discovered the “correct” strategy, whereas inexperienced deaf peers did not. Possible causes and implications of the observed effects are discussed as they relate to early experiences of deaf children and their lack of early, effective access to language.

Implications

Deaf children have been shown to lag behind hearing peers in several kinds of problem solving. Often, such differences have been attributed to impulsivity on the part of deaf children. This study demonstrates that deaf students do not spontaneously use information about the categories of things (e.g., animals, vehicles) during a problem solving task, and that the lack of such a strategy can hinder performance. Importantly, deaf children were found to be no more impulsive (or reflective) than hearing peers, and impulsivity was unrelated to performance. Rather, the results are consistent with other recent studies suggesting that deaf and hearing students may have different organizations in long-term memory which may influence performance on some kinds of tests.


This article reviews theoretical and empirical issues concerning the relations of language and memory in deaf children and adults. An integration of previous studies, together with the presentation of new findings, suggests that there is an intimate relation between spoken language and memory. Either spoken language or sign language can serve as a natural mode of communication for young children (deaf or hearing), leading to normal language, social, and cognitive development. Nevertheless, variation in spoken language abilities can be shown to have a direct impact on memory span. Although the ways in which memory span can affect other cognitive processes and academic achievement is not considered
in depth here, several variables that can have direct impact on the language-memory interaction are considered. These findings have clear implications for the education of deaf children.

Implications

Deaf and hearing individuals demonstrate differences in both short-term and long-term memory. In short-term memory, the language used “in the head” can affect how much is remembered. In long-term memory, deaf and hearing students were markedly similar kinds of knowledge about things, but they may differ in the organization of that knowledge at the level of individual concepts and at the level of interconnections among concepts. Differences in memory processes and/or the organization of knowledge may influence performance in a variety of academic and other domains.


The present study examined similarities and differences in the organization of verbal concept knowledge in deaf and hearing individuals. That organization has been shown to influence performance by hearing adults in a variety of tasks that entail language and memory, but comparable studies comparing deaf and hearing individuals have not been conducted previously. A single word semantic association task was used here to investigate part of the mental lexicon involving words that were either sound-related or not sound-related. The normative procedure allowed estimates of the size of the associative set for a given word and the strength of relation between the word and individual associates within the set for deaf and hearing college students. Results indicated that the mental lexicons of deaf and hearing individuals vary in several ways relating to the coherence or consistency of concepts across individuals. At the same time, there was remarkable consistency between the groups, and the organization of concepts that are sound-related and not sound-related did not vary with hearing status. The results are discussed in terms of both theoretical and practical implications.

Implications

Reading, problem solving, and other academic tasks frequently require relatively automatic access to the meanings of words. Reading comprehension, in particular, depends on the interconnections among concepts activated by words on the printed page; and we know that the automatic retrieval of word meanings tends to be slower in young deaf readers. The present study demonstrates that while deaf and hearing students have very similar knowledge about common words, there are also consistent differences. Deaf students tend to have concepts that are less clearly defined and less strongly interconnected with related words. Such differences may be one factor in observed challenge is in deaf students’ reading comprehension.


Deaf and hearing school children in India were given a test of digit span and five tests that measured visual spatial skills. The two groups were matched for age and gender. All deaf children had severe to profound hearing loss from birth, had hearing parents with no other deaf person in the family, and did not know any sign language. The deaf group showed a shorter digit span than the hearing group, consistent
with previous studies. Deaf and hearing children did not differ in their performance on the visual spatial skills tests, including one on which deaf ASL signers have been found to perform better than hearing non-signers. These results suggest that deafness by itself may not lead to better visual spatial skills. Early exposure to sign language and fluent sign skills may be the critical factors that influence the development of visual spatial skills in deaf people.

Implications

Since deaf people primarily rely on visual information for communication and learning, it is easy to consider them as more accomplished visual learners than hearing people. Indeed, there is not considerable evidence that deaf signers perform better than hearing non-signers on many visual tasks. The results of this study, however, suggest that a deaf child I not necessarily better than a hearing child in visual skills and deaf children among themselves may differ in their visual skills. Some deaf children may be stronger visual learners than others, perhaps based on their sign language background.


The literature on learning disabilities (LD) and attention deficit disorders (ADD) in the deaf population is reviewed within the broader context of mainstream research on LD and ADD. Problems of definition, evaluation, and syndrome complexity that hamper progress in understanding the nature of LD and ADD in the deaf population are discussed, and some promising new directions for research on evaluation and remediation of LD and ADD are identified.

Implications

LD and ADD are the largest categories of additional disabilities among deaf children. Teachers often note that schools seriously underserved deaf children with LD and ADD and that finding effective ways to identify and accommodate the learning needs of these children is an urgent priority. While progress has occurred in understanding, identifying, and remediating LD and ADD in hearing children, very little specific research on these issues exists for deaf children. This chapter discusses the small literature on deaf people with LD and ADD and suggests new evaluation and research approaches based on the more advanced literature on hearing people.
English Reading and Writing

One way to improve students’ access to and retention in postsecondary degree programs is to accurately assess their readiness for such programs. To more accurately place deaf and hard-of-hearing students in preparatory courses and determine their readiness for degree programs at NTID/RIT, a direct measure of writing was developed. The purposes of this study were to estimate the validity of this measure. That is, we wanted to estimate how well the new measure compared with an established measure and how well it predicted success in the university’s gateway Freshman composition course. Results provide evidence that it orders students similarly to The Test of Written English (Educational Testing Service, 1992). It also predicts how long it will take students to complete the Freshman composition course.

**Implications**

This test may be used as a rough, early predictor of readiness for degree programs at NTID/TIT. Along with other indications of a student’s English language and writing ability, the results of the test may be used to help them prepare for degree programs and to select appropriate degree options.

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In semi-structured interviews, 20 men and women (10 deaf and 10 hearing) between the ages of 18 and 28 recalled instances of instrumental, social and expressive writing from their childhoods. In contrast to earlier research, we found that instrumental writing occurred as frequently between deaf children and their hearing parents as between deaf children and their deaf parents and that all homes with a deaf family member had telecommunication devices for the deaf (TTY’s). Whereas all respondents engaged in some form of social writing, deaf respondents did less personal or expressive writing than their hearing peers.

**Implications**

Implications for literacy instruction and further research are that (1) teachers should take advantage of the writing experiences that students bring to the classroom, (b) writing should be used as a tool for learning and classroom communication, and (c) the effects of experience, genre, school setting and technology on the writing of deaf students should be examined.

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This chapter reviews the existing research on the acquisition of English syntax by deaf learners and, based on recent theoretical developments in linguistics, offers a new theory-based approach to understanding the impact of deafness on English language acquisition. It is shown that many of the English structures that are difficult for deaf children and adults to acquire (questions, relative clauses, auxiliary verbs, articles, quantifiers, etc.) are those that involve “functional categories.” Functional categories include complementizer, inflectional, and determiner phrases. Many deaf learners learn the “lexical categories” that the functional categories contain (nouns, verbs, etc.) but not the functional categories themselves. In this sense, many deaf learners tend to learn “smaller” languages because of the limited access they have to spoken language input.
Implications

Much of the previous research on the English language knowledge of deaf children and adults has been descriptive rather than explanatory. It has identified and described English language structures that cause deaf students difficulty, but it has not generally explained the difficulty. In explaining relative difficulties among syntactic structures, this chapter exposes teachers of deaf students to recent developments in linguistics and offers a principled view of the variation in deaf students' English language knowledge. The chapter also underscores the need for more research on deaf children's English language acquisition and on finding better methods for facilitating the learning of English in educational settings.


English WH-questions look simple but are actually quite complex formations that can pose great difficulty to language learners. This article explored deaf college students' knowledge of English WH-questions within the context of current linguistic theory. The results of a question formation task and a grammaticality judgment task revealed that some WH-question types (Who called the director on the telephone?) are easier to learn than other types (Who did the director call on the telephone?), which are still easier to learn than other types (Who does Brenda think the director called on the telephone?). The learnability of WH-questions depends in part on how far the WH-word moves from its logical position (e.g., as the object of the verb call in the second and third examples above) to the beginning of an English sentence. Mastery of the harder WH-question types improved as general English language proficiency level increased.

Implications

The ability to ask and answer questions is vital to success in a college environment. The teaching and learning process requires teachers and students to ask and answer questions and requires students to answer questions in textbooks and on written assignments and examinations. The results of this study revealed that many deaf college students still have limited knowledge of English WH-question structures. Therefore, teachers need to recognize difficult question structures, need to help students improve in their knowledge and use of questions, and need to revise materials containing difficult question structures to make them more accessible to students.


Indirect tests of writing competency (e.g., tests with multiple-choice items) are often used at the college level for a variety of educational, programmatic, and research purposes. Although such tests may have been validated for use with hearing students, it cannot be assumed that they validly assess the writing competency of deaf and hard-of-hearing students. This study used a direct measure of writing competency, the Test of Written English (TWE), to determine the validity of two indirect measures of writing competency. With the TWE, students write an actual essay, which is then scored by professional raters. Results of this study suggest that the validity of indirect writing tests for deaf and hard-of-hearing baccalaureate-level students is weak.
Implications

The demonstrated low validity of the indirect writing tests examined in this study suggests that indirect writing tests in general are inappropriate for use with deaf and hard-of-hearing baccalaureate-level students. With indirect writing tests, invalid testing could result in a student being inappropriately denied acceptance to a particular college or program, being placed in the wrong course or program of study, being inappropriately passed or failed in a course, not graduating on time, graduating without requisite writing skills, or not qualifying for a certain job. Therefore, direct writing tests should be used with these students.
Sign Language
Using a systematic process developed at NTID during the 1970's skilled signers knowledgeable about legal, social work secretarial, science and mathematics were interviewed in order to collect the signs they use for terminology in each of these areas. These signs, together with signs collected from previously published materials, were then shared with other experts who provided judgements of the acceptability of these signs. Based on the results of this process, and respondents' sociolinguistic background, signs were selected for inclusion in these publications/videotapes, which are disseminated on a national basis. In addition to information about this process and signs, (1) the legal-social work book includes suggestions and guidelines for effective use of sign language vocabulary for legal and social work terminology and information and readings from the National Association of the Deaf and the Registry of Interpreters for the Deaf, and (2) and the science and mathematics book includes a selected reading list on science and mathematics education for students who are D/deaf. Also, both books include a feedback form for readers as part of the research efforts needed in order to ensure NTID sign language materials for technical communication continue to reflect current usage by skilled signers.

Implications

Artificial versus natural sign language vocabulary development continues to be a major issue in how to best sign in academic settings. The results of the process used to document and select signs for inclusion in the above publications/videotapes, as well as other similar NTID sign language publications/videotapes for technical terminology, support that effective communication in academic environments can be supported through a systematic process for documenting and sharing signs used by skilled sign language communicators. Thus, rather than artificial sign development or invention, research efforts should focus on observing, documenting, and sharing what skilled signers do. Such efforts take advantage of the natural mechanisms in all languages, be they spoken or signed, for developing the vocabulary needed for communication by language users.


This paper discusses the mutual contributions of linguistics and the study of sign language. Linguistics has both guided sign language researchers in ways of approaching data and given us tools to analyze those data. At the same time, the study of sign language can contribute to our understanding of language in general, especially the question of what is universal about language vs. what is universal to the spoken modality. It can also, precisely because of the modality differences, provide evidence for aspects of linguistic theory that spoken language cannot. Another contribution that the study of sign language can make to linguistics is in the area of language variation and how it is influenced by education.
Implications

In schools for hearing children, there are so-called “language arts” courses that teach children about the language they already supposedly know. These courses usually teach the standard language of the community which some of the children may not have been adequately exposed to. Even in many so-called bi-bi programs for deaf children, there are not equivalent language arts courses in ASL, and such courses are missing in the vast majority of schools for the deaf, not to mention in mainstreamed settings. The result is probably greater variation in the language than is found in spoken English.


Isolated signs and ASL sentences were presented to 14 native signers at rates varying from 1 to 6 times normal speeds. Signers were asked to copy the signs or sentences on videotape. For the signers, accuracy dropped precipitously either between 2-3 times or between 3-4 times normal speeds. Also, error types shifted from more semantically or syntactically based to more formationally based as one went from lower to higher speeds. The rates at which the breakdown occurred are the same as for time-compressed speech, suggesting that there is an overall ceiling in processing rate which is independent of modality.

Implications

The original work in time-compressed speech made it possible to make recordings for blind persons that could come close to matching the rate of reading vs. speaking. Theoretically, this research could mean that signed information could be sped up so that signers could get more information per unit of time than would be possible through natural speeds of signing. However, two factors that limit the implications of this study must be kept in mind: first, all of our subjects were native signers, and native signers are but a small percentage of the population; second, longer narratives might be fatiguing as compared to relatively short sentences.


Integrative motivation, the desire to relate to the target culture (Deaf people), was found to correlate significantly with ASL proficiency for adult learners at a post secondary program for deaf students. Instrumental motives, those which relate to personal gain, were perceived as less important. Moreover, unlike many studies conducted with students in K-12 or college environments, adult learners reveal an intrinsic motivational orientation, that is, the desire to be the best they can be in their established positions as professionals. Higher achievement in ASL was also associated with a positive cultural attitude toward deaf people.

Implications

Following the classic studies by Robert Gardner, many researchers have shown the importance of considering motivational factors in second language acquisition. Few studies have been conducted with adult learners. The results of this study indicate that the learning of ASL as a second language may be enhanced if sign language instructors design strategies that build upon these cultural and integrative motives and provide rewarding experiences to adult learners.

This study focuses on specific factors that motivate and demotivate professionals to learn American Sign Language (ASL). Using a qualitative approach known as the Critical Incident Technique (CIT), faculty and staff were asked to reflect on their sign language learning experiences, and their responses were examined for motivational patterns. Principal motivating factors included personal goals and an interest in ASL as a visual language. Integrative factors were also important, especially an interest in social interactions with deaf people. Principal factors that demotivated the respondents were more extrinsic in nature, dealing with workload and its relationship to sign class offerings and scheduling, issues associated with the sign language curriculum and instruction, and the attitudes of self and others.

**Implications**

American Sign Language has an important role in the education of many students who are deaf. This study reveals that there are many factors which motivate and demotivate adults learning ASL which should be taken into consideration by those responsible for the preparation of professionals in Deaf education, as well as those responsible for ongoing professional development. Individual differences in motivations indicate a need for careful planning of sign language curricula and teachers well trained in effective pedagogical principles with adult learners, including affective dimensions.

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College age students, who are D/deaf and hard-of-hearing (N = 231), were administered (1) an objective test of their sign language communication skills (the Sign Instruction Placement Interview/SIPI), (2) an objective test of their spoken communication skills (Write-Down Speech Intelligibility Test), and (3) a paper and pencil questionnaire which includes self-assessment items for sign language and spoken communication skills (Language Background Questionnaire/LBQ). The results showed a high degree of congruence between the objective measures of students’ sign language and spoken communication skills and their self-assessments; that is, the higher students scored on the objective assessments the higher they self-rated themselves on the LBQ items for sign language and spoken communication skills. The LBQ also includes an item on preferred communication mode (PCM), and further study is planned to investigate the relationship between PCM and sign language and spoken communication skills.

**Implications**

Results of this study support that young D/deaf and hard-of-hearing adults are able to accurately self-assess their sign and spoken language communication skills. Self-assessments are not intended to supplant detailed diagnostic testing for educational and rehabilitation purposes. However, when general information about young D/deaf and hard-of-hearing adults’ communication skills is what is needed, the simplicity, ease and economy of administration and interpretation of the LBQ supports its use, rather than the use of more time consuming, costly, and intrusive objective assessment approaches. Future investigation of the relationship between preferred communication mode (PCM) and communication skills may provide additional insights into the benefits of using instruments such as the LBQ.
Socialization and Culture
Based on interviews with deaf adults, barriers to communication between deaf and hearing people at home, school, and work are explored. It is proposed that these communication barriers make it difficult for deaf people to acquire the wealth of social and cultural knowledge which hearing people learn incidentally, i.e., through observation and overhearing the conversations of others. Failure to access technical, social and cultural information has many negative consequences, ranging from inaccurate perceptions of social protocols to missed information about procedures to be followed in completing school and work tasks. While interpreters and notetakers are helpful in providing deaf people with access to direct or formal communications, they are much less helpful in facilitating access to incidental or informal learning experiences. On a more positive note, the deaf community may be, in part, a natural outgrowth of the communication barriers which deaf people encounter in interactions with hearing people. Through interactions with one another, deaf people find many of the experiences they miss with hearing people, including friendship, meaningful conversations, information and community.

Implications

Often, family members, teachers, and employers of deaf people assume that if the person has an interpreter or notetaker, they have full access to the environment. However, these support services are only the first step in accommodation. The key to full inclusion in these settings involves changes in the attitudes and behaviors of hearing persons. Making sure the deaf person has access to “the grapevine,” explaining informal rules and expectations, and including the deaf person in casual conversations are just a few examples of ways in which hearing people can fully include deaf persons.

This chapter does not present research findings; rather, it is about the nature of doing research involving deaf persons. Researchers use various models to guide their investigations. These models make basic assumptions about deafness and how to research the lives of deaf people. Three models of deafness are discussed: medical, social/cultural, and political. While one model is not presumed to be better than the others, each provides a different perspective from which to explore deafness. The impact of each of these models on research in deafness is discussed. The chapter is concluded with a discussion of the author’s approach to research, the models she has worked with, and strategies she has used to reflect an understanding of the lives of deaf people that is consistent with these models.

Implications

Historically, much of the research done with deaf persons has been conceptualized from a medical perspective. This chapter offers researchers (and others who work with deaf people) alternative models of deafness and explores how these models impact research. It also raises issues such as who can and should be doing work in deafness, the politicizing of the field over the past 10 years, and strategies which researchers should consider as they go about their daily work.

Communication involves sending and receiving signals. However, it is also a form of social engagement. Constraints on communication between deaf and hearing persons often result in strained interactions as well as loss of "full" information. In this paper, a meta-ethnographic approach is used to describe the impact of "spoiled" communication on social engagement between deaf and hearing persons.

**Implications**

Often the focus of research in communications has been on sending and receiving signals. While this is a very important topic, it is only one dimension of communication. Understanding the social, emotional, and political dimensions of communication and the impact of communication breakdowns on social interactions and relations between individuals can lead to strategies for repairing strained communication and delivery of complete information to both parties.


At a time when the disability community is defining itself as having a culture and calling for a celebration of differences rather than exclusive focus on conformity and inclusion, why is it that people who consider themselves culturally Deaf often distance themselves from the disability movement? If deafness is not a disability, should deaf persons be entitled to SSI payments, special schools, and the protection of laws such as the Americans with Disabilities Act? What are the implications for educational policy and practice? In this chapter, these and other questions are tied to questions of "disability as difference" and the place of deafness in the growing field of disability studies.

**Implications**

Deaf Culture and Disability Culture are on a collision course. In what ways are they similar? On what points do they differ? Are their goals compatible or in conflict? These and other questions must be addressed if both groups are to succeed in addressing their various philosophical and political agendas. This chapter focuses attention on the fit between deafness and disability and provides a starting place for discussion and dialogue by scholars and activists in both groups.


The perspective that deaf people should be primarily regarded as a cultural and language minority group rather than as individuals with audiological disabilities is critically examined. Historical and general sociopolitical context is provided to consider the concept of deaf people as a bilingual-bicultural group. The use of a medical versus sociocultural model is also discussed. Deaf people are compared with other hearing minority groups in America to examine the issues related to development of self-identity and group-identity and it is concluded that deaf people’s experiences often overlap with the experiences of other hearing minority groups but at other times are unique. The book organization and its scope are also provided in this chapter.
Implications

This chapter makes a case for a systematic academic analysis of the concept of bilingual-bicultural identity, and the importance of understanding the experiences of deaf people within the general context of cultural and language diversity. Understanding the theoretical issues and research findings in the general fields of bilingualism-biculturalism and minority education and discussing their implications for deaf education are important steps that can help us in designing effective educational policies and programs that recognize and support a deaf child’s identity development as a bilingual-bicultural minority member of a society.


This paper begins with a discussion of the sociocultural model of a deaf child as a member of a bilingual minority and examines its implications for deaf education. A case is made for recognizing ethnic diversity within the deaf community in designing and implementing educational programs and policies that strengthen the self-identities of deaf children. Several issues related to the accommodation of the diversity of deaf learners are discussed illustrating how such accommodation would enhance their educational experiences. The use of technology, its potential to accommodate diverse deaf learners, and its influence on the deaf community are also discussed.

Implications

Acknowledging the cultural identity and diversity of deaf children and the complexity of their psychosocial experiences is the first step toward developing educational programs that meet the needs of individual deaf learners and help them realize their full potential. This article discusses some of the key concepts and issues related to cultural identity and diversity in deaf education. The goal of this article is to inspire some fresh insights, new thinking, and innovative approaches to deaf education.


This study investigated the expressed attitudes of deaf people in India toward career choices for deaf and hearing people. Deaf adults from Pune, India rated the suitability of 12 professions for deaf and hearing people and gave written comments on the suitability of any other professions they could list. The results, in general, were consistent with those of other studies in the United States, England, Italy, South Africa, and India with hearing teachers and parents of deaf children and showed that the hearing status of the imagined advisees selectively influenced attitudes toward suitability of certain professions. Some differences in profession preferences also emerged which indicated that the deaf respondents’ criteria for career choice appeared to be primarily based on the use of hearing, speech, and visual skills in that career. These findings underscore the importance of understanding the attitudes of deaf people.

Implications

This study taken together with previous studies suggest that educational and technological opportunities alone are not sufficient to overcome attitudinal bias in either deaf or hearing people. Teachers and counselors as well as deaf people need to examine the subjective criteria they apply in giving career
advice to deaf and hearing students. Documentation of the expressed attitudes of deaf people is an important first step in working toward attitudinal change in both hearing and deaf people. This study helps to clarify both the universal and the culturally specific challenges faced by deaf people.


Parent-child communication plays a central role in social growth, as it does in other domains of development. Over 90% of deaf children, however, have hearing parents who frequently do not have a fully effective means of communicating with them. This paper examines the role of effective parent-child communication in the social and emotional development of deaf children. Evidence concerning relations between early communication and social-emotional development of deaf children is reviewed, and superficial differences in the ways that parents interact with deaf versus hearing children are distinguished from differences that may have more significant and enduring effects. Hearing parents and their deaf children are found to develop alternative, often nonverbal, interaction strategies. Of primary interest is the extent to which those strategies have impact comparable to the strategies of hearing parents with hearing children or deaf parents with deaf children.

**Implications**

This review of literature relating to deaf children’s early social and communication experience emphasizes the interaction of those two domains. Early exposure to effective communication is seen to be a central part of development, helping young children to develop secure bonds with their parents, appropriate social skills, and contributing to their own self-esteem and sense of identity. Deaf children face particular challenges in this regard, because most of them are unable to benefit significantly from spoken language, but their hearing parents usually do not have fluent skills within sign language. Consistency and clear communication are show to be the keys to success.

This paper describes and evaluates a computerized, adaptive test-delivery system for the measurement of speech discrimination. Using a modified discrimination task, the testing system draws on a pool of 130 items spanning a broad range of difficulty to estimate an examinee’s location along an underlying continuum of speech processing ability, yet does not require the examinee to possess a high level of English language proficiency. The system is driven by a mathematical measurement model which selects only test items which are appropriate in difficulty level for a given examinee, thereby individualizing the testing experience. Test items were administered to a sample of young deaf adults, and the adaptive testing system evaluated in terms of respondents/sensory and perceptual capabilities, acoustic and phonetic dimensions of speech, and theories of speech perception. Data obtained in this study support the validity, reliability, and efficiency of this test as a measure of speech processing ability.

**Implications**

The Speech Sound Pattern Discrimination Test provides a valid, reliable and efficient means of assessing the speech processing abilities of severely and profoundly deaf young adults. It has many advantages over conventional measures of speech processing ability. Specifically, it is comprised of sentence-level stimuli, is not dependent on listeners’ expressive English skills, and has been shown to be sensitive to variations in listeners’ auditory processing capabilities and properties of the speech signal. These characteristics make the test a potentially useful tool in educational settings.


A test was constructed to show if a deaf lipreader derives benefit from amplification. We wanted pairs of phrases or sentences that were distinguishable only through their sound or vibration pattern, but not lipreading (example: “Emergency” vs. “Help her get a seat”). Ten deaf college students viewed 24 such pairs spoken by two talkers (96 items total). On each trial, students read a pair of choices, watched one item spoken, and guessed which one it was. In a lipreading-only condition, 39 items proved to be visually confusable, as desired. Of these, 16 were reliably disambiguated when sound was added (lipreading plus listening). Nearly half of these also had distinct tactile patterns when presented to artificially-deafened adults feeling a vibrator. The 16 new items, compared to a conventional battery of measures, successfully identified good listeners in a group of 27 young adults with widely ranging communication characteristics.

**Implications**

Educators and researchers frequently compare lipreading-alone to lipreading-plus-listening to determine if deaf students effectively use hearing aids. Lipreading scores can increase 10%-50% when sound is added, but students’ skills (extremely good or poor lipreading) can interact with the material (too simple, or esoteric) to obscure the effect. This new forced-choice procedure offers a solution that does not depend on English competence, as do write-down identification tests, and can be repeatedly readministered. Yet it uses everyday speech. Applications include comparing listening devices, demonstrating change before and after instruction, and convincing skeptical students or teachers that sound is beneficial.

Profoundly deaf male college students with a wide range of speech and lipreading skill participated in two weeks of lipreading instruction. The aim was to study whether the experience of seeing oneself talk could improve later lipreading skill. Forty-eight students practiced with visually-confusable monosyllables that required attention to subtle articulatory cues. They lipread either themselves or the trainer, either during or after pronouncing the syllables, via a closed-circuit TV system. A pretest-posttest comparison indicated that students who lipread themselves obtained significant gains overall in recognizing a new talker’s visually-confusable monosyllables, but those who practiced lipreading the trainer did not. Significant gains were found on untrained items only when the order of practice put articulation first, followed by viewing one’s own speech.

**Implications**

This study confirmed earlier work by Anthony van Uden that linking visual and kinesthetic feedback — the look and feel of one’s own speech — can improve the lipreading of other talkers. Results from this diverse group of deaf college students suggest that even well-ingrained habits of auditorily-unintelligible speech do not preclude benefit from practice in lipreading one’s own speech. Improved recognition of untrained syllables was observed only in the delayed-visual-feedback group, highlighting the added benefit of requiring students to access memory during visual feedback training.

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This study investigated the potential influence of alterations in the temporal structure of speech produced during simultaneous communication on the perception of final consonant voicing. Experienced signers recorded words that differed only in the voicing characteristic of the final consonant under conditions of speech-alone and simultaneous communication. The words were digitally edited to remove the final consonant and played to 20 listeners who identified the word they thought they heard. Results indicate that accurate perception of final consonant voicing was not impaired by changes in the temporal structure of speech that accompany simultaneous communication.

**Implications**

For deaf children in a classroom where simultaneous communication is employed, even though speech is longer in duration, the understanding of that speech should not be affected.

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This study investigated speaking rate and voice onset time (VOT) in speech produced during simultaneous communication by speakers with normal hearing. VOT is a timing feature of spoken English important for perception of consonant voicing. Results indicate that although VOT voicing contrasts were enlarged when using simultaneous communication, they still follow the VOT voicing rules of spoken English.
Implications

The deaf child who is in a classroom where simultaneous communication is used is exposed to the VOT voicing rules of English which are an important factor in the production of intelligible speech.


This chapter focuses on a) a description of studies and programs which have employed computer-assisted, interactive video to teach speechreading-lipreading, b) an outline of techniques for determining the general pedagogical strengths and weakness of computer applications for speechreading instruction, and c) an examination of methods for assessment of speechreading skill acquisition during training as opposed to traditional pre/post-test methods of documenting student progress.

Implications

Speechreading skills are improved with intensive drill and practice with multimedia, computer-assisted instruction. Further, it is practice with current video disc or state-of-the art, CD ROM video technology and lap-top computers. Families with deaf or hard-of-hearing children can have access to effective means to improve communication skills.


The purpose of this study was to investigate the effects of envelope fluctuation on temporal gap detection. Temporal gap detection thresholds were measured in amplitude modulated noisebursts. Detection was studied at six modulation depths and in four phase conditions which placed the onset of the silent gap at different amplitudes on the temporal envelope of the waveform. Gap thresholds were obtained in a 31FC paradigm in four young, normal-hearing subjects. The smallest mean gap threshold, 3.5 ms, was obtained for unmodulated noisebursts. The largest mean gap threshold 25.7 ms, was obtained at a modulation depth of 100%. Phase did not significantly affect gap detection until modulation depth was increased to 40%. At deeper depths of modulation, gap thresholds were smallest but also most variable, when the gap onset was placed at a peak in the waveform envelope and largest when the gap was centered on an envelope minimum or randomly placed. Results of this study are consistent with previous findings and the hypothesis that gap detection is dependent on the similarity of the gap itself to inherent fluctuations in the stimulus envelope, reflecting coherence in terms of phase and depth of envelope fluctuation.

Implications

This study demonstrated that temporal resolution in humans reflects not only the frequency and intensity of the signal but also complex phase relationships as well as the depth of the sinusoidal amplitude modulation of the carrier. Temporal resolution became much less acute with small increases in stimulus complexity. These relationships help us understand the age-related changes in hearing which are characterized by difficulty in understanding speech in complex listening environment. Small increases in the complexity of the listening environment resulted in large increases in speech understanding problems.

The purpose of this study was to clarify and extend the results of earlier studies of age-related effects on temporal resolution by precisely matching young and old subjects with normal hearing and measuring gap thresholds in a variety of listening conditions. Younger subjects were between 17 and 40 years of age, older subjects between 64 and 77 years. Signals were noisebursts which varied in upper-cutoff frequency, overall level, and sinusoidal-amplitude-modulation depth. Signals were presented in quiet, in a noise floor, and with a gated-high-frequency masker in a noise floor. Significant main effects were found for signal frequency, intensity, modulation, age, and background condition. Mean gap thresholds ranged between 2.1 and 10.1 ms and were larger for the older subjects in all 24 conditions. In some conditions, introduction of a noise floor increased the gap thresholds of the older subjects relative to those of the younger. Analyses of individual data support the conclusion that the mean differences between groups reflect shifts in the distributions of gap thresholds of the older subjects towards poorer temporal resolution.

**Implications**

A general decline in the speed of behavior is one of the most ubiquitous and significant characteristics of older adults whether hearing or deaf. This study is the first demonstration of a purely age-related change in the speed of temporal processing. We have been able to characterize the change as occurring in roughly half of older adults with essentially normal absolute sensitivity. These subjects showed relatively poorer temporal acuity in noisy or complex listening conditions with respect to the temporal acuity of audiometrically matched younger subjects. The increase in the between-subject variability in the older group suggests that this decline in temporal resolution is not an inevitable consequence of aging but can be expected to occur in all individuals whether hearing or deaf.


The purpose of this investigation was twofold: (a) to determine if there are changes in specific temporal characteristics of speech that occur during simultaneous communication; and, (b) to determine if known temporal rules of spoken English are disrupted during simultaneous communication. The general findings indicate that speakers with normal hearing consistently reduce their rate of speech when using simultaneous communication, but do not violate specific temporal rules of English important for consonant and vowel perception.

**Implications**

Although the model of speech presented to deaf children by teachers using simultaneous communication is slower in duration, these children are being exposed to important temporal rules of spoken English.

This purpose of this investigation was to study the effect of sign complexity on temporal features of speech during simultaneous communication. Signing complexity was determined as: (a) sign task demand (base vs. elaborated signs); and, (b) type of sign movement (kinetic vs. morphokinetic). Selected temporal measurements of sentences produced with simultaneous communication were measured. Results indicated that signs with greater complexity were accompanied by significantly longer silent intervals before the experimental word. This is an indication of the preparation necessary to produce a more complex sign while trying to maintain as high degree of simultaneity as possible.

Implications

This study suggests that for young deaf children in the simultaneous classroom, it may be best to use simpler signs in order to reduce the temporal disruptions to speech which can occur with more complex signs.
Teaching and Learning

The goal of the project was to determine the effect postsecondary education has on reducing dependency on social welfare (Supplemental Security Income (SSI) payments) by deaf persons. The project assessed the impact that educational level, age and gender have on receipt of SSI payments. The Social Security Administration matched a data file of 7,196 deaf individuals provided by NTID to national records of individuals receiving SSI benefits in October 1995. Data released by the SSA followed strict confidentiality guidelines. No data for individuals who made up the pool of subjects were reported. The SSA provided only tabular information to NTID.

The study found that 20 percent of the individuals in the data file received an average SSI benefit of $342 in October 1995. Second, the more education an individual has, the less likely she or he will draw on SSI. Third, individuals who attend college and subsequently drop out receive SSI benefits at a rate similar to those who never attended college. Fourth, as an individual ages, she or he draws significantly less SSI benefits. Finally, a significantly larger percentage of females than males received SSI benefits at all age levels. In summary, postsecondary education serves to reduce the dependency on social welfare (SSI) by deaf and hard of hearing persons.

Implications

Educators of deaf individuals at the elementary and secondary levels need to encourage every able deaf student to access postsecondary education. Additionally, deaf individuals capable of pursuing postsecondary education need to be encouraged by vocational rehabilitation and other social service professionals to pursue postsecondary education. This study and earlier studies of earnings indicate that use of public funds to support higher education of deaf individuals is a sound investment. It is clear that public policy supporting postsecondary education of deaf individuals yields earnings benefits in excess of educational support costs and significantly reduces long term dependence on Federal SSI payments.


This article provides a brief summary of a national survey that collected information on the instructional technology resources available at schools serving deaf students in the United States. One of the objectives of the survey was to determine the capability of schools to participate through the Internet in distance learning activities. The results showed that over 70% of the schools have availability to Internet and World Wide Web (WWW) access for deaf students. Because access to instructional technologies is only a part of an educational solution, this article continues with an exploration of some innovative uses of the Internet and also provides examples of specific applications for deaf students.

Implications

Teachers who have convenient and regular access to technologies such as the Internet and the WWW and, more importantly, the skills to use such technologies can offer a variety of new instructional options for their students. Those of us who work with teachers of the deaf as researchers, instructional developers, and teacher trainers need to stay abreast of such technologies. How we can most effectively train ourselves, the instructors with whom we work, and our deaf students is an issue that we have yet to resolve.

A course, called “Improving Your Conversations,” was developed at NTID and evaluated after it had been taught for two years. The course is taken by students who have speech that is at least semi-intelligible and who want to improve their effectiveness when conversing with non-signing hearing partners. A theoretical model used throughout the course defines what a conversation is and visually displays the interrelationships among its components. Lectures, discussions and activities combine to foster self-awareness, knowledge of what to do in specific situations, and communication competency both within and outside the classroom. Students engage in a series of five activities leading to the establishment of personal goals for the course. They then participate in skill development activities, peer conversations, interactions with RIT hearing students, and conversation logs. At the end of the course, students complete an evaluation form commonly used at NTID. Results from the first two years show that most students felt that they made practical and personal gains, found specific activities helpful, and increased their conversational competency and confidence.

**Implications**

From both the evaluation of data and the authors’ perspectives after teaching Improving Your Conversations, it is apparent that college-age students benefit from direct instruction in conversational management. Also, written comments from the students indicate that they feel more confident after learning skills such as “how to start a conversation,” “what to talk about,” how to “branch to new ideas,” and “how to change topics.” It seems reasonable to expect that younger students would benefit from similar instruction which teaches them about conversations and provides multiple opportunities for practice and feedback. They would learn about cultural-linguistic variations in conversations and have skills that they could apply to conversational exchanges when speaking, signing, or using simultaneous communication.


A learning community based on a model of linked courses was implemented for 14 freshmen with low reading and writing test scores compared to other entering students at a college for students who are deaf or hard-of-hearing. Instructors collaborated on curricular objectives supporting successful learner behaviors, and discussed student progress weekly. A deaf student teaching assistant and intensive career and personal counseling were also provided. Goals were to develop attitudes and behaviors that would support positive academic experiences, engender feelings of connection, and thereby increase the likelihood of program completion. Compared to a control group, the experimental group more often attended class and submitted homework on time, was perceived as putting in more effort, and completed more courses. Students appeared to benefit from the clustered learning environment and intensive monitoring of their progress. Weekly staffings and an older deaf student as a teaching assistant were other key components of the project.

**Implications**

Participation in a Learning Community is known to increase retention of students in colleges for normal-hearing students. It enhances feelings of connection to the academic environment which can result in
more time spent on learning. The outcome is greater academic success, which engenders greater persistence and, ultimately, completion of the program. This study suggests that the benefits reported for normal-hearing college students can be achieved at the postsecondary level for students who are deaf and hard-of-hearing. The current effort, with three linked courses and regular faculty consultation, represented a modest “cost” to the students and the faculty. Despite its limited scope, the results still favored the Learning Community. If fewer students leave school before completing a program, we can achieve a more cost-effective program and benefit greater numbers of students in achieving their personal and career goals.


This article explores how deaf students and their instructors experience mainstream college classes. Both quantitative and qualitative procedures were used to examine student access to information and their sense of belonging and engagement in learning. Instructors were asked to discuss their approach to teaching and any instructional modifications made to address the needs of deaf learners. Results indicate that deaf students viewed classroom communication and engagement in a similar manner as did their hearing peers. Deaf students were more concerned about the pace of instruction and did not feel as much a part of the “university family” as did their hearing peers. Faculty generally indicated that they made few if any modifications for deaf students and saw support service faculty as responsible for the success or failure of these students. Results of these and additional findings are discussed with regard to barriers to equal access and strategies for overcoming these barriers.

Implications

Several specific recommendations for practice emerge from this study. First, emphasis should be given to the similarities between deaf and hearing students, and those instructional practices which enhance learning for everyone. Second, instructors should be selected for interventions who are interested and willing to modify their teaching strategies to facilitate inclusion of all students. Third, intervention strategies should be practical, reasonably easy to implement, and disseminated through user friendly vehicles. Fourth, excellence in teaching should be rewarded.


MainePOINT (Providing Opportunities for Integrating New Technologies) was a project to deliver instruction in American Sign Language to high school students via interactive television. The MainePOINT project was large and multi-faceted and NTID researchers became involved in a collaborative effort to determine the characteristics of students who are successful with such a distance learning format and those who are not. One hundred and twenty students from eight high schools throughout Maine registered for the course and prior to the start of the course, completed a learning style scale and self-concept scale. Results indicated that students who were most successful and who liked this type of instruction the best (previous grade-point average was factored out) described themselves as “curious and excited about new things,” had a desire to “control their own learning pace,” had “previous exposure” to other technology in education and had “low anxiety” in using technology.
Implications

Results of this study confirmed those found in a previous effort that examined satisfied and dissatisfied students enrolled in two NTID/Gallaudet courses offered via distance learning. In both cases, successful and satisfied students were those who were familiar and comfortable with the technology being used and who valued the control and independence afforded by the instructional format. Students who describe themselves as needing more interpersonal contact or who generally are not comfortable with technology are less successful. Teachers considering offering courses via distance learning should make every effort to be sure their students are familiar and comfortable with whatever technology is being used.


This chapter provides an overview of the educational applications of technology for students who are deaf, hard of hearing, blind, or partially sighted. It describes and discusses current, state-of-the-art instructional and educational technology along with practical examples of utilization for each of the identified student populations. Examples from actual classroom applications are included. A literature review is provided, with emphasis on computers and related technology.

Implications

This is a practical guide for pre-service and in-service teachers to obtain a comprehensive summary of the current technology applications with exceptional learners, as well as the potential for future use. Activities and resource references for the various technologies and pertinent organizations are provided.


Six learning style dimensions of the Grasha-Riechmann Student Learning Style Scales (GRSLSS) were examined in this study with 100 deaf college students. In addition, six corresponding scales of teaching emphases were administered to the 16 instructors of these students. Student mean scores were higher for the dependent, participative, collaborative and independent dimensions than for the competitive and avoidant styles. The participative learning style correlated significantly with course achievement and course interest, which suggests that an emphasis on active learning may be desirable. For instructors, as with students, the mean scores for teaching emphases were found to be higher for the collaborative, dependent, participative, and independent dimensions. The similar patterns of results for students and teachers suggest a correspondence between the learning styles and the teaching emphases.

Implications

The correspondence between the teacher and student ratings in this study may have reflected both common perceptions and common experiences with regard to how teaching and learning occur in the classroom. Thus, the expectations of students and teachers are likely to be compatible, which may facilitate instruction in the classroom. This study, however, adds to a growing body of research supporting participative learning with regard to achievement. Teachers should experiment on an increasing basis
with strategies that involve all students, including questioning techniques that lead to each student responding, and other hands-on/minds-on activities. Since students vary in their preferences, a wise teacher will also offer a variety of teaching approaches during a course in order to allow all students to learn through their preferred styles and effectively strengthen other styles in the process.


C-Print is the name given to a computer-aided speech-to-print transcription system that has been developed as a classroom support for deaf and hard of hearing students in mainstream educational environments. The system involves a hearing captionist (transcriber) typing the words of the teacher and other students as they are being spoken. The system provides a real-time text display that the deaf student can read on a second laptop computer or a TV monitor to understand what is happening in the classroom. The text file is also stored in the computer for later editing and distribution to students, teachers and tutors. Research and evaluation with the system has indicated that students like the system and feel the completeness of the information is one of the major benefits. Studies indicate that C-Print captioners record approximately 66% of the information spoken in class and 76% of the important information.

Implications

No single channel of receptive communication (e.g., speechreading, sign reception, reading) can be entirely suitable for all deaf and hard of hearing students under all conditions. Evidence is accumulating, however, which indicates that a transcription system such as C-Print is an effective way of increasing accessibility to information in the mainstream classroom for many deaf and hard of hearing students. In the near future, we anticipate learning a great deal more about the type of mainstream environments were C-Print can be used most effectively and the characteristics of students for which the service is the most appropriate.


Three different teaching and learning strategies for problem solving were implemented with first and second year deaf college students enrolled in math courses at the National Technical Institute for the Deaf (NTID) at the Rochester Institute of Technology in Rochester, New York. These strategies involved the students in 1) explaining to a peer observer in sign language followed by writing their understanding of a problem and its solution; 2) visualizing their problem-solving process prior to actually starting to solve a problem; and 3) observing their teacher modeling step-by-step the analytical process for a sample problem prior to solving math word problems. The students were asked to solve two types of problems — typical math word problems and a visual/manipulative puzzle to provide a contrasting problem-solving experience to problems presented in text format.

Implications

The findings of this research demonstrate that the problem-solving performance of deaf college students can be positively influenced with instructional strategies. While the results show that students' reading
levels can have an influence on their explanations of a problem and it’s solution, the data also show that deaf college students can improve their problem-solving analysis and explanations by applying a procedural model that was demonstrated by the teacher. Furthermore, strategies that are designed to get the students to think more carefully prior to trying to solve a problem are also beneficial. While the problem-solving strategies in this study were examined with deaf and hard-of-hearing college students, such strategies would appear to be appropriate and applicable to high school deaf students who are college bound because they should be capable of reflective and analytical thinking. A number of related suggestions for improving problem-solving skills are presented and discussed.


This project identified key issues concerning participation of deaf and hard of hearing (D/HH) students in regular (mainstream) classes. In one study, qualitative data were collected from 40 participants in focus groups consisting of interpreters, teachers of the deaf, and notetakers. In a second study, repeated field observations were made of four elementary level D/HH students who were participating in small group learning activities with hearing classmates. Focus group comments indicated that regular classroom teachers, interpreters, teachers of the deaf, hearing classmates, and D/HH students contribute to active participation by the D/HH student. Focus groups identified specific barriers that interfered with participation of each of these groups of individuals and they also identified specific strategies to facilitate participation. Qualitative analyses of field observation data yielded results consistent with the comments collected from the focus group participants. The observations identified accommodations that regular classroom teachers, teachers of the deaf and interpreters can make to promote integration of the D/HH student. A summary synthesis of the data presents 16 specific strategies for overcoming barriers to participation.

Implications

Teachers and support staff can use 16 specific strategies to promote the participation of D/HH students:
1) Regular Classroom Teacher. (a) Provide a communicative environment for the entire class that encourages participation by the D/HH student. (b) Create effective small group learning situations that include the D/HH student. (c) Meet with the teacher of the D/HH and interpreter to discuss ways of facilitating participation and learning of the D/HH student. (d) Demonstrate and promote positive attitudes towards the D/HH student.
2) Teacher of the D/HH. (a) Provide information about deafness. (b) Problem-solve communication/relationship difficulties. (c) Organize special activities for D/HH and hearing students. 3) Interpreter. (a) Facilitate communication of the D/HH student with teacher and hearing classmates. (b) Contribute information about deafness. (c) Assist the classroom teacher with supporting students’ learning. 4) Hearing Students. (a) Participate willingly in activities with others, regardless of whether they are hearing or D/HH. (b) Have skills for effective communication. (c) Be familiar with characteristics of D/HH students and become comfortable interacting with these students. 5. D/HH Students. (a) Actively participate in class activities and perceive hearing classmates as having positive or neutral attitudes. (b) Have communication skills for participating in the regular classroom. (c) Know how to participate in small group learning activities.

The difficulties faced by deaf students in mainstream settings in understanding the teacher and in participating in class discussions and activities have been well documented. In dealing with these difficulties, printed information is especially valuable to many deaf students. In view of the value of printed information, a number of investigators and providers of resources for communication access of deaf students have used real time speech to print transcription systems with deaf students. These systems transcribe the speech into print at the same time the words are being spoken. These systems use a hearing transcriber keying in either a verbatim or condensed version of what the speaker is saying. After the presentation or lecture, the text file stored in the computer can be examined by students, tutors, and instructors by reading a computer monitor or hard-copy printout. This paper describes recent progress with two systems: (a) A steno-based system in which a trained court reporter produces a verbatim display of what is being said; and (b) the “C-Print” system under development at the National Technical Institute for the Deaf.

Implications

The C-Print system uses technology to provide a cost effective means of increasing communication access for deaf and hard of hearing students in mainstream settings. The system provides a quality option that many students consider as good or better than the current services of interpreting and notetaking. The service increases the tools that educators have to efficiently support students in the mainstream. Providing the C-Print system, along with other support services, should enable school programs to meet demands for services in a cost effective and successful fashion. Frequently there are not enough qualified interpreters to fill requests. Also, where there are two interpreters and a paid notetaker in a class, these services are expensive. The C-Print service can fill some of this demand at a reasonable cost. It can do so because the technology is inexpensive, there appear to be many potential operators, and the operators can be trained to provide quality service in a short time. The system is particularly timely, given that more deaf and hard of hearing students are being enrolled in local schools and require support services (Schildroth & Hotto, 1994), even as funds for special education services are declining.


This is the report of a national meeting conducted in 1997 on the campus of Rochester Institute of Technology and co-hosted by the University of Rochester. The threefold purpose of the meeting was to define the current status of automatic speech recognition (computer conversion of speech into text), to discuss potential applications of value to deaf and hard of hearing children and adults, and to share this information with product developers and with deaf and hard of hearing people as potential users for purposes of communication. Topics included its current status and projections over the next five years, particularly for its ability to transcribe the natural speech of people engaged in dialogue, and practical considerations in its use by deaf and hard of hearing people. The full proceedings are available on the Web at: http://www.isc.rit.edu/~ewcncp/Lovejoy.html
Implications

While several large vocabulary, continuous speech recognition products are now available, none is capable yet of transcribing ordinary spoken language interactions into text, e.g., for classroom applications, with acceptable accuracy. However, experts who made presentations expressed optimism that applications with deaf and hard of hearing people will occur within the foreseeable future, beginning perhaps with formal “speaker to audience” situations where communication is essentially unidirectional.


The reports of five committees of this national task force have been distributed nationally and posted on the Web at http://www.rit.edu/~netac/publication/taskforce. These are:


Three additional reports are currently in press:


Implications

More than 20,000 deaf and hard of hearing students presently attend, and seek special services in approximately different 2,000 colleges and universities throughout the U.S. Some offer more extensive services than others. These reports and others to follow are intended to give guidance to these institutions in providing services of high quality to their present deaf and hard of hearing students and to others in the future. The reports should also enable many deaf and hard of hearing students to become better-informed consumers of these services.