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ABSTRACT

This document presents reports of three projects to identify and analyze the appropriate use of instruction in Braille, optical devices, and other technologies as they relate to literacy and employment of individuals who are blind or visually impaired. The first project examined the choice of reading medium of 68 individuals (blind or visually impaired) matched by employment status and primary mode of communication. The second project analyzed available training curricula for various reading modalities (Braille, low vision devices, and technology) and the teaching of reading to people with visual impairments. The third project involved a meta-analysis study of literacy and persons with visual impairments. Over 70 publications were incorporated into this review of the literature. The document presents the full text of the following five reports based on these projects: (1) "Literacy, Employment, and Mode of Access to Printed Information" (Rita Livingston and Laurel Tucker); (2) "Overview of Braille Literacy for Rehabilitation Teachers" (Lynne Luxton); (3) "Training for Reading with Low Vision" (Marshall E. Flax); (4) "Using Assistive Technology in Literacy Education for Learners Who Are Blind or Visually Impaired" (Jay Gense and Marilyn H. Gense); and (5) "The Relationship between Literacy and Employment for Persons with Visual Impairments: A Review of the Literature" (Alana M. Zambone and Mary Jean Sanspree). (Individual papers contain references.) (DB)

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Prepared by the
Pennsylvania College of Optometry

for the
Mississippi State University
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on Blindness and Low Vision

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July, 1997

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Increasing Literacy Levels: Final Report

Overview

This research program was composed of three projects to identify and analyze the appropriate use of and instruction in Braille, optical devices, and other technologies as they relate to literacy and employment of individuals who are blind or visually impaired.

Literacy and the Choice of Access to Print

The objective of this project was to study choice of reading medium and its relationship to literacy and level of employment among adults with visual impairments. This research effort resulted in the attached report, "Literacy, Employment, and Mode of Access to Printed Information" by Dr. Rita Livingston and Ms. Laurel Tucker.

The target population consisted of 72 individuals who were blind or visually impaired. There were matched groups by employment status and primary mode of communication (i.e., Braille, optical devices, or technology). Interviews were conducted and data collected, including a follow-up interview. At the time of the preparation of the final report, data were available for all but one matched pair in the technology group. Therefore, the data presented in this report are based on 68 individuals who were blind or visually impaired. The principal investigators are pursuing data on a final matched pair on their own time and hope to incorporate that information into any journal publications, presentations, and other forms of project dissemination. The details of the findings of this project are presented in the attached report.

An Analysis of Available Training Curricula for Reading Modes and Teaching Reading for Persons with Visual Impairments

The objective was to prepare and publish curricula sources with qualitative review of current publications for teaching reading through various modes to persons with visual impairments. Curricula were to be identified that were available for teaching reading by Braille, optical device use, and technology. The results of this phase of the study are attached as "Overview of Braille Literacy for Rehabilitation Teachers", "Training for Reading with Low Vision", and "Using Assistive Technology in Literacy Education for Learners who are Blind or Visually Impaired".

A thorough investigation of the literature, which included the traditional library and archival searches, and advertising in professional journals and newsletters to locate available curricula, confirmed that no widely used curricula exist in the areas of study. Therefore, members of the research team determined that the field would be best served by investigating the literature and agency-developed curricula materials in three specific areas: Braille, low vision device application, and technology; to present qualitative information on what did exist; and to supplement the findings with additional material that the rehabilitation community would find most useful in practice. The results were the development of three monographs that can be published and widely disseminated to those who work with persons who are blind or visually impaired.

The first is an "Overview of Braille Literacy for Rehabilitation Teachers" by Dr. Lynne Luxton. Dr. Luxton explains "Braille literacy" and then through a series of questions and answers, discusses the role of the rehabilitation teacher with regard to: Braille literacy, the types of literacy situations the rehabilitation teacher might encounter, the Braille teaching texts that are available, guidelines for developing Braille practice materials, information about Braille transcription services, how to choose Braille text books, criteria for good Braille teaching texts, differences in teaching Braille to children and adults, teaching models currently used in teaching Braille reading to children, learning styles for adults, motivational strategies for teaching Braille, use of volunteers to teach Braille, and other most often expressed questions and concerns about the teaching of Braille by rehabilitation teachers. Also included as an appendix to this report is a recent publication *Rehabilitation Teaching Braille Textbook Review* by Cheryl Richesin, M.Ed. available through the Rehabilitation Teaching Division of AER.

The second, "Training for Reading with Low Vision", was developed by Marshall E. Flax. This is a manual meant to provide the reader with access to the available information on teaching people with low vision how to read using optical devices. The target audience is those who are working directly with individuals with low vision and have as their goal increased reading ability. Mr. Flax explains why we provide training in reading with optical devices and then proceeds to define various categories of low vision devices such as handheld magnifiers, stand magnifiers, head borne and spectacle mounted loupes, reading glasses, telemicroscopes, and closed circuit televisions. He then discusses what rehabilitation personnel should do prior to training and provides a sequence of training activities put forth in the past, and considered to be classic for the training of reading using optical devices including general guidelines. He also presents guidelines for increasing efficient use of visual skills without devices as well as with devices. He closes with a discussion of future needs. In addition, he provides an annotated bibliography of 10 of the primary resources available in the field today.

The third monograph is "Using Assistive Technology in Literacy Education for Learners who are Blind or Visually Impaired" by Jay and Marilyn Gense. They begin by introducing the concept of literacy and technology. They discuss the need for basic technology skills in school and work environments; the use of technology in schools and work environments by individuals who are blind or visually impaired; and access to computers for individuals who are blind or visually impaired including Braille input/output, synthetic speech systems, and optical character recognition systems. A major section on assessing assistive technology is presented in three major sections: general information regarding computer use; software selection; exploration of the four primary adapted mediums available (enhanced image, Braille/synthesized speech, optical character recognition/synthesized speech systems); and access to CD-ROM technology. They also discuss Internet access, use in general and for users who are blind or visually impaired, and close with a discussion of issues and implications for future access to information via technology including funding strategies and resources.

A Meta-Analysis Study of Literacy and Persons with Visual Impairments

The objective was to perform a meta-analysis of studies related to literacy and access to information for individuals with visual impairments. This project resulted in an in-depth review of the literature and delineates the relationship between literacy and reading modes for persons with visual disabilities and where possible, demonstrates how the factors relate to employment. The results of this effort are presented in "The Relationship Between Literacy and Employment for Persons with Visual Impairments: A Review of the Literature".

Drs. Alana Zambone and Mary Jean Sanspree were the Principal Investigators of this project. They along with students from the University of Alabama at Birmingham conducted an in-depth search of the literature regarding literacy and employment of individuals with visual impairments. They reviewed over 100 publications and incorporated over 70 into a comprehensive review of the literature. Categories of analyses included: the story of Braille and other modes for accessing information, literacy and employment, employer expectations, the role of rehabilitation counseling and education, employees' perspectives on requirements for vocational placement, developing or recapturing literacy for adults with vision loss, issues on Braille instruction, and the relationship between low vision and literacy and technology and employment. They offer conclusions such as: Case studies appear to be the preferred methodology that use quantitative design. Further, though there is a presumed relationship between literacy and success in the workplace, no studies were identified that address a correlation between literacy levels and successful employment. Therefore, the research need in this area is blatantly apparent. The authors offer suggestions for the collection of needed data to support the relationship between literacy and employment.

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Literacy, Employment, and Mode of Access to Printed Information

Rita Livingston, Ph.D.
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Literacy, Employment, and Mode of Access to Printed Information

In the United States, the assumption exists that an individual's employability is directly related to the level of literacy possessed by that individual. For the person with a visual impairment, literacy is impacted not only by education and cognitive ability, but also by the reading and writing medium the person uses to access or share print information. This study addresses the choice of access to print information by individuals who are visually impaired and its relationship to literacy and level of employment. The specific objectives are to evaluate literacy levels within and between the groups, as well as to evaluate the choice of reading medium for job tasks and the individual's knowledge of alternative choices for accessing the print environment.

Target Population

The target population of this study is 72 individuals (36 employed and 36 unemployed) who are visually impaired and between the ages of 25 and 60. Among the employed participants, 12 are Braille users, 12 are optical device users, and 12 are users of technology. Each employed group is further stratified by professional/technical job (6 individuals) versus other (6 individuals) and divided between congenital or adventitious visual impairment. The unemployed group was recruited after employed individuals and matched on medium used (i.e., Braille, optical device, technology), congenital or adventitious visual impairment, and level of education achieved. All participants were evaluated using an interview, demographic information sheet, and the standardized Nelson Denny Reading Inventory.

At the time this report was written, two participant matches in the technology group were missing. One–hundred–seven participants were tested to obtain the matches needed. Participants were recruited across the country with selections made from Pennsylvania, New Jersey, Tennessee, Massachusetts, Florida, Georgia, Texas, and Washington. There were four individuals tested in the technology group for which a match was unavailable. Finding the matches required proved to be an extremely difficult task even with 4 years time. Because the matches were not obtained, the data analyses were completed with the four missing subjects in this group. The effect of the four missing participants in this group on the data analyses is unlikely to change the results of the study.

Population Description

Through interviews, descriptive data were gathered on all study participants. Within the age range of the study, most of the participants were in the 35 to 46 age range (Table 1).

Table 1. Age of Participants

25 – 36 years	21
37 - 46 years	32
47 - 56 years	15
TOTAL	68

Nineteen males and 48 females were represented. Congenital visual impairment was represented by 53 participants while 14 individuals were adventitiously impaired. Table 2 shows the composition of the most commonly mentioned etiology of visual condition.

Table 2. Etiology of Visual Condition

Retinopathy of Prematurity (ROP/RLF)	15
Cataracts	11
Retinitis Pigmentosa	10
Glaucoma	6
Albinism	4
Macular Degeneration	4
Leber's	3
Diabetic Retinopathy	2
Retinoblastoma	1
Myopia	2

The highest level of education attained by the participants varied: 18 graduated from high school or obtained a GED, 11 obtained some college, 9 received an associate degree, 14 graduated with a bachelor's degree, 2 obtained some graduate credits, and 14 obtained a master's degree.

Most participants received their education in the public school, 18 with support of a teacher of the visually impaired (VI) and 10 with no support from a VI certified teacher. Nineteen participants received their education from a combination within the array of services. Eight participants had no visual impairment during their public school years.

At the time of the study, 34 participants were employed, 34 were unemployed or employed less than 75% time. The definition of employment for this study was considered to be more than 75% time. Using the classification of jobs supplied by the *Dictionary of Occupational Titles*, 15 participants were employed as professional or technical and the remaining 18 were classified as "other".

Reading and Writing Media Choices

Participants were interviewed to determine the most frequent medium used in reading and writing in the settings of home, school (either current use or use when they last attended school), community, and on the job. They were asked about both their primary (the one most often used) and secondary medium in each of the categories to obtain a sense of the variety of options used in the various settings.

Home Reading and Writing

In the home, participants obtained primary access to printed materials (reading) most frequently through Braille, audio tapes, records or discs, closed circuit television (CCTV), optical device, or prescriptive glasses or contact lenses. The most common secondary options included audio tapes, records or discs, CCTV, and optical device. Braille dropped to 6 participants; regular print was chosen by 5 participants, and sighted assistant was used by 4 individuals. The primary method of writing was Braille followed by regular print, large print, CCTV, and prescriptive glasses or contact lens. The secondary writing medium was more stratified across the choices with the most common being regular print, typewriter, and computer. One individual listed the slate and stylus (Table 3).

Table 3. Home Reading Primary Medium

Braille	13
Print (standard)	2
Large Print	2
Sighted Assistance	2
Technology	1
Audio tape, record, disc	15
CCTV (standard print)	9
Optical Device(s)	10
Reading Machine	1
Optacon	1
Prescriptive Glasses or Contact Lens	10
TOTAL	66

Community Reading and Writing

Within the community, the overwhelming choice of accessing printed materials was the sighted assistant with optical devices and prescriptive glasses or contact lens as the next most frequent choices. As the secondary choice for accessing printed materials, the sighted assistant was still the most frequent choice with optical device and prescriptive glasses or contact lens remaining, however, Braille was listed by 11 participants. The primary choice for writing in the community was regular print and sighted assistant with 8 using prescriptive glasses or contact lens. The secondary choice remained regular print for 13 participants. Writing their signature was the secondary choice of 26 individuals (Tables 4 and 5).

Table 4. Community Reading Primary Medium

Sighted Assistant	37
Optical Device(s)	11
Prescriptive Glasses or Contact Lens	10
Large Print	2
Print (standard)	5
Braille	1
CCTV	1
TOTAL	67

Table 5. Community Writing Primary Medium

Sighted Assistance	20
Print (standard handwriting)	21
Large Print	6
Prescriptive Glasses or Contact Lens	8
Optical Device	2
Write Signature	5
Braille	3
Technology	1
TOTAL	67

School Reading and Writing

During their most recent school experience, participants gained access to printed materials most often through audio tapes, records, or discs. Eleven used sighted assistants or prescriptive glasses or lenses; 7 participants used Braille and 7 more used prescriptive glasses or lenses. The secondary choice was listed as sighted assistants, prescriptive glasses or lenses, audio tapes, records or discs, or regular print (Tables 6 and 7). Writing within the school setting was much more diversified than in the community. Braille, regular print, and audio tapes were the most common. Three participants used computers while 4 used typewriters. As a secondary choice, the typewriter became the overwhelming choice by 29 participants. Braille and regular print were the next most frequent (Tables 8 and 9).

Table 6. School Reading Primary Medium

Audio tape, record, disc	15
Sighted Assistance	11
Prescriptive Glasses or Contact Lens	11
Braille	7
Not Applicable	7
Optical Device(s)	6
Large Print	4
Print (standard)	4
Optacon	1
CCTV (standard print)	1
TOTAL	67

Table 7. School Reading Secondary Medium

Sighted Assistance	16
Audio tape, record, disc	12
Print (standard)	11
Not Applicable	7
Optical Device(s)	5
Braille	5
CCTV (standard print)	4
Optacon	1
Prescription glasses/lenses	1
Large Print	2
TOTAL	72

Table 8. School Writing Primary Medium

Print (standard handwriting)	17
Braille	12
Audio tape, record, disc	8
Not Applicable	7
Large Print	4
Prescriptive Glasses or Contact Lens	3
Typewrite	4
Sighted Assistance	3
Optical Device(s)	3
Computer with Speech	1
Slate and Stylus	1
Brailler	1
CCTV	1
Computer	2
TOTAL	67

Table 9. School Writing Secondary Medium

Typewriter	29
Braille	7
Print (standard handwriting)	7
Not Applicable	7
Audio tape, record, disc	2
Sighted Assistance	3
Large Print	4
Computer	2
Computer with Speech	1
Writes signature	1
Slate and Stylus	1
TOTAL	66

On-The-Job Reading and Writing

Reading on the job for both the primary and secondary choices was highly diversified. The most common access modes were CCTV and optical devices. Five participants chose sighted assistant and 4 participants chose each of the following: Braille, regular print, computer with speech, and prescriptive glasses or lenses (Table 10). Secondary choices changed to optical devices, sighted assistant, computer, and prescriptive glasses or lenses. For writing, the main choice was computer with speech, with other choices being Braille, regular print, and computer (Table 11). The secondary choices were more diversified with typewriter, regular print, Braille, large print, and computer.

Table 10. Job Reading Primary Medium

Not Applicable	24
CCTV	7
Optical Device(s)	7
Compute with Speech	4
Sighted Assistance	5
Print (standard)	4
Prescriptive Glasses or Contact Lens	4
Braille	4
Large Print	2
Computer	3
Optacon	2
Technology	1
TOTAL	67

Table 11. Job Writing Primary Medium

Not Applicable	23
Computer with Speech	11
Braille	6
Print (standard handwriting)	5
Computer	5
Large Print	4
CCTV	4
Optical Device	3
Braillewriter	3
Prescriptive Glasses or Contact Lens	2
Slate and stylus	1
TOTAL	67

Current Primary Reading Medium

Participants were asked to identify their current primary reading medium. Braille was stated by the most participants. The remaining more frequent responses were regular print, audio tapes and optical devices, and large print and CCTV (Table 12).

Table 12. Primary Reading Medium
Participant's perceived *current* primary reading medium

Braille	21
Print	15
Optical Device(s)	11
Large Print	6
Audio tape, record, disc	7
CCTV (standard print)	9
Unknown	1
Sighted Assistance	1
Prescriptive Glasses or Contact Lens	2
Reading Machine	1
TOTAL	67

Employment Satisfaction

Three questions were asked to the employed participants about their present job. In response to how they felt about their chance to make use of their abilities and skills, 1 was not satisfied, 10 were slightly satisfied, 14 were satisfied, nine were very satisfied, and 3 were extremely satisfied. The second question asked how participants felt about the opportunities in this job for challenges and professional growth in their line of work. Six were not satisfied, 10 were slightly satisfied, 10 were satisfied, 6 were very satisfied, and 3 were extremely satisfied. The final question asked if they believed their current job skills would enable them to work at a higher level position of employment. Twenty–four responded "yes", 4 responded "no", 6 responded "maybe", and 3 said they didn't know.

Questions About Options

In an attempt to ascertain participants' current perception about present and available options, two questions were asked. The first question asked if their options for reading and writing allow them to function independently in all of their present situations. The majority (35) responded "yes". Those who were affirmative but with special accommodations numbered 10. Those who said "no, not in all situations" numbered 9, while 13 responded "no". When asked if additional options for reading and writing would be beneficial to them, only 1 participant said they didn't know. Forty–eight indicated "yes" and 18 responded "no".

Data Analysis

The data gathered to answer the major research questions were analyzed using a 3 X 2 Factorial Design with an analysis of variance. Follow–up *t*–tests were used to investigate interaction effects. The dependent variables were vocabulary, reading comprehension, and reading rate. Independent variables were employment status, mode of access (i.e., Braille, optical device, or technology), type of job (professional/technical or other), and vision status. Even though the groups were not evenly matched, the affect on the final analyses of the two pairs of individuals missing from the technology group could not be determined. The demographic data were reported by frequency measures.

Results

The research questions were:

1. **Is there a difference in literacy levels as related to employment status?**

The data indicated there were no differences.

	Total Score Adjust Time	Total Score Reg. Time	Reading Rate
DF	64	64	64
N	33		
Probability	0.4896	0.1727	0.1307

2. **Is there a difference in literacy levels as related to mode of access?**

The data indicated there were no differences.

	F	Prob.
Total Score, Adjusted Time	1.70	0.1915
Total Score, Regular Time	0.06	0.9394
Reading Rate	0.55	0.5796

3. **For each mode of access, is there a difference in literacy levels as related to employment status?**

The data indicated there were no differences in total scores for Braille, optical device, and technology users within the adapted time allowance, within the regulation time, or with reading rate for Braille and optical device users. However, an Independent *t*-test for the variable reading rate and employment for technology users showed no difference between the employed and unemployed groups on the two-tailed test but was significant on the one-tailed test. The interpretation is that employed individuals have a higher reading rate than unemployed individuals among users of technology.

Braille Mode	Total Score	Total Score	Reading Rate
	Adjust time	Reg. Time	
DF	22	22	22
N	24	24	24
Probability	0.3405	0.3752	0.3858

Print Mode	Total Score	Total Score	Reading Rate
	Adjust time	Reg. Time	
DF	22	22	22
N	24	24	24
Probability	0.4880	0.1281	0.1196

Technology Mode	Total Score	Total Score	Reading Rate
	Adjust time	Reg. Time	
DF	16	16	16
N	18	18	18
Probability	0.2104	0.1517	0.0387

4. **What is the relationship between type of job and vision status as they relate to choice of medium?**

The multiple regression analysis indicated a significant relationship between onset of visual impairment (congenital or adventitious) and reading mode. This is a predictable relationship but also may be affected by the greater numbers of congenitally visually impaired participants.

Analysis of Variance $F = 11.5348$ $P = 0.0019$

$t = 3.3963$ $P = 0.0019$

Nelson-Denny Reading Test Standard Scores With Adapted Time Allowance (Reg. Time X 2.5)

	Mean	Std. Dev.
Vocabulary	322	13
Comprehension	306	15
Total Score (V&C)	317	14

**Standard score mean = 300. Standard deviation = 15.*

Nelson-Denny Reading Test Standard Scores
at the End of Regulation Time

	Mean	Std. Dev.
Vocabulary	320	14
Comprehension	292	70
Total Score (V&C)	289	32

**Standard score mean = 300. Standard deviation = 15.*

Nelson-Denny Reading Test reading rate. **The reading rate of a majority of participants was 120 words per minute or less.**

Follow–up Interview of 18 Randomly Selected Participants

A follow–up interview occurred with 18 randomly selected participants. The participants were selected through the use of a random table of numbers with each participant receiving a unique number from 1 to 68. Questions were gleaned from demographic and interview data which were thought to have some value for explanation of the results. The original intent was for this interview to be one of depth. However, the original interview was so comprehensive that the follow–up became much shorter. Participants were contacted by phone and asked the following questions:

1. **Over 70% of participants desire more available options for reading and writing. What additional options would you like to have and use?**

   Most responses were related to technology (even by those already using adaptive technology). Those already using technology desired (a) to have new equipment at home like that being used in the workplace; (b) additions such as speech output or large print display; and (c) access to Windows 95, on-line databases, and more information available on disks. A suggestion was made for "user friendly" systems for easier printing of envelopes and checks with home computer systems. Several participants said they would have greater independence and privacy if they had a portable optical character recognition scanner at home. A new tool for reading/accessing handwriting was also desired. Another's need was for increased availability of human readers.

2. **Only about half of the full-time employed individuals who participated in this study expressed satisfaction with the opportunities in their job for challenges and professional growth. What are factors that you perceive that may contribute to dissatisfaction in the job for adult workers who have visual impairments?**

Participants perceived that attitudes and perceptions of supervisors and coworkers contributed to frustrations and job dissatisfaction among visually impaired workers. They also found that accommodations and appropriate training needed to be provided for any worker to competently accomplish job tasks at any level of employment. It was noted that there is less job security, increased responsibilities, and fewer opportunities for advancement with current downsizing in most places of employment.

3. **Most full-time employed individuals who participated in this study felt that their current job skills would enable them to work at a higher level position of employment. What factors do you perceive may exist that keep them from working at a higher level position of employment?**

External and internal factors were perceived to potentially prevent adults with visual impairments from working at higher positions of employment. Common external factors included prejudiced attitudes and misjudgments toward the "disabled," no room for advancement or dead-end jobs, corporate downsizing increased paperwork and difficult details without increased sighted assistance in higher positions, and the limited ability of specialized access technology to keep up with rapid growth and change in the global technology arena. An individual may choose not to advance for personal reasons. Internal factors may be a desire to stay comfortable with what is known rather than make changes and take risks, lack of confidence in one's skills and abilities, and preference to not relocate to a new area (e.g., issues of family, transportation, mobility).

4. A. **What technology options used by adults with visual impairments are you presently *aware* of today?**

B. **If you were personally seeking to obtain a better job (or a job), would technology expertise (new or additional) help you?**

All participants in the telephone follow-up indicated that they would benefit from new or additional technology if seeking a new or better job. The responses included developing basic skills with equipment and advanced training to use CD-ROM, learning the Internet, and exploring new software applications.

5. **The majority of participants in this study used tapes and readers when in school (college, if attended, or high school).**
A. Why do you think this is so?

B. What do you believe should be the accessible choices or options available for school related materials?

C. How can preferred media for education be made more accessible?

Most adults in the follow-up interview believed that school related materials should be available in multiple formats used by students with visual impairments. Thus, the suggested choices/options included Braille, large print, audio tape, computer disk, CD-ROM, and live human reader. Multiple advantages were given for making available books on disk and included quick selective searches, immediate access of recent publications, and outputs capable in speech, Braille, and print. Suggestions were offered that publishers provide available textbooks on disk, technology be more affordable, rental equipment be an option, and libraries invest in adaptive equipment to be available for use by any student/person.

6. **A. What do you perceive needs to happen to make your community environment more accessible with regard to options for reading and writing?**

B. What changes have you seen in your community over the past 5 years (1991–1996)?

Suggestions for improved community access included company bills and statements available in adaptive media; telephone and computer banking; improved access to ATMs; accessible formats of documents such as health insurance, banking; and community information available on the Internet (e.g., public transportation schedule, newspaper, library card catalog). Although local radio reading programs may provide access to newspapers and magazines, it is limited; a portable receiver with headphones was suggested to increase one's utilization of this special programming.

Discussion

Within the participants in this study, literacy skills (i.e., vocabulary, reading comprehension, and reading rate) as measured by the Nelson–Denny reading inventory did not account for the difference between the employed and unemployed individuals who were visually impaired. Through the interviews of participants, many variables were apparent which might account for the unemployed status. For those participants living in rural areas, transportation to and from the job site was a factor. Health status (physical and psychological), which may or may not be related to the etiology of the visual condition, appeared to be a factor in several cases. Skill in and the proficient use of technology may have been a factor in unemployment. Knowledge of the various options for types of work, the skills required within various job categories, and the individual's match between the required skills and the perceived personal skills possessed was less evident in some of the unemployed individuals. Use of technology for writing within the school setting was very low. This could be a factor related to most of the participants falling within the age ranges of 37–46 where technology was not available during the school years. The question should be asked to determine if technology is currently being used at a higher rate among today's students.

Even with the passage and implementation of the Americans with Disabilities Act, access to information within the community most often requires the help of a sighted assistant. Individuals are using optical devices and prescriptive lenses. Perhaps more attention should be given to information access within communities both to written/print materials in general and with regard to transportation in particular and the impact this accessibility might have on employment. The impact might be on the perception of competence of visually impaired individuals by the employing public. All of these factors need to be explored.

Most of the technology users accessed the CCTV. Use of computers with speech was not an option within the technology category. Reading rate generally increases through listening over print or Braille reading. The fact that the employed technology group had a faster reading rate than the unemployed group requires further investigation. It is difficult to determine whether the employed group was faster because of practice or whether the speed of accessing materials was a factor in their employability.

Further study needs to occur to determine some of the significant variables that affect employment and unemployment for the population of visually impaired adults. A different measure of literacy skills might yield additional information. Social/interpersonal skills have been stated to have a great impact on the ability of individuals who are visually impaired to retain jobs. Perhaps it is time to study this theory.

References

U.S. Department of Labor, Employment and Training Administration, U.S. Employment Service. (1991). *Dictionary of occupational titles.* Indianapolis, IN: JIST Works.

Overview of Braille Literacy for Rehabilitation Teachers

Lynne Luxton, Ed.D., CRT

Introduction

"Overview of Braille Literacy for Rehabilitation Teachers" is intended to help rehabilitation teachers (RTs) take proactive roles in teaching Braille and fostering literacy with adult clients. The Overview is written in a question and answer style to encourage dialogues about Braille and literacy.

Definition of Braille Literacy

The term "Braille literacy" is frequently used but not often defined. It will be helpful to look first at "literacy" and then combine it with the medium of Braille. Koenig (1992) classifies literacy into three types: emergent, basic or academic, and functional. **Emergent literacy** is the process of learning that abstract symbols have meaning and that they can be used for communication. **Basic or academic literacy** is school grade level literacy which should be at the 8th grade level for adequate skills to continue lifelong learning. **Functional literacy** encompasses those skills used in daily life in the home, workplace, and community. Koenig states that independently gaining access to print is also a necessary literacy skill for people with visual impairments. Literacy includes reading and writing in a primary medium for oneself and for communicating with others in appropriate media.

The term "Braille literacy" means that a person uses Braille as his/her primary medium for literacy. For new adult clients, Braille literacy takes on a slightly different meaning: The client has literacy skills using print and is learning Braille as a transcription code for print. The client will use Braille but most likely will not use Braille as his/her primary medium. As with literate print readers, most literate Braille readers learned Braille in school as children. Less than 20% of all people who are blind or visually impaired read grade 2 Braille. This is a relatively small number of people, but Braille is essential for their literacy activities.

Role of Rehabilitation Teachers for Braille Literacy

Rehabilitation teachers (RTs) are responsible for knowing and teaching grade 1 and grade 2 Braille to clients, most of whom are adults. RTs are not required to be professionally prepared to teach children or to teach the process of reading. School-age clients who lack adequate reading or literacy skills are referred to special education vision programs. Adult clients who lack literacy skills are referred to adult basic education classes. RTs work with the adult basic education and adult literacy personnel to assist them in obtaining materials in appropriate media, and to provide training about the effects of visual impairments.

RTs at the Canadian National Institute for the Blind and literacy specialists at the Nova Scotia Department of Education and Culture have developed a successful model training program and useful materials entitled *A Guide to Braille Literacy* for training literacy tutors to work with adults learning grade/basic Braille (The Canadian National Institute for the Blind [CNIB], 1996).

Background of the Braille Literacy Movement

The Braille literacy movement began more than 150 years ago with attempts to educate children who were blind or visually impaired. It was due to Louis Braille's ingenuity and perseverance that he created a tactual system for reading and remarkably, for writing. Louis Braille and his blind colleagues who "tested" his system in 1829 knew the value of reading and writing independently. Previous tactual systems were embossed print letters used for reading only; people who were blind did not have writing devices for embossing print. Without the ability to write, literacy was not possible.

France accepted the Braille system in 1854 and Great Britain did so in 1905. In 1929, the British referred to Louis Braille as the "Gutenberg of the Blind" (*The Braille Centenary*, 1929, p. 3) during the national celebrations of the 100th anniversary of the invention of Braille and the 400th anniversary of the Gutenberg printing press.

Meanwhile, the United States was not united in their teaching of Braille and carried on the "War of the Dots" for decades until 1932 (Irwin, 1955). This dissent among proponents of five different tactual codes resulted in a dearth of tactual literature produced in incompatible codes. Literacy was stymied for people who were blind. Finally in 1932, American and British representatives signed a uniform code agreement designating Grade 2 literary Braille as the official code. The result was the *English Braille, American Edition* code book known to all Braillists. Congress gave authority to the Library of Congress, National Library Service for the Blind and Physically Handicapped (NLS) for the collection and free distribution of Braille books (*That All May Read*, 1983). NLS also became the certifying agency for Braille transcribers and proofreaders. The Braille Authority of North America (BANA) authorizes Braille codes. BANA is working with the International Council on English Braille to develop a Unified Braille Code (Bogart, 1991).

"Home teachers" in England were the first instructors of tactual reading for adults. Dr. William Moon, blinded in midlife, invented Moon Type embossed print in 1850. Literate women who were blind served as home teachers who traveled to client's homes to teach Moon Type. In 1892, Dr. Moon and John Rhodes of Philadelphia founded the "Pennsylvania Home Teaching Society and Free Circulating Library for the Blind." This was the beginning of rehabilitation teaching in the United States.

The Braille Literacy Movement is receiving public attention boosted by federal legislation Section 504 of the Rehabilitation Act and the Americans with Disabilities Act. Newspaper stories have focused attention on Braille reading and the lack of it by visually impaired youth who use computers but cannot read Braille. Was Braille being replaced by low vision devices, synthesized speech, and technology? In response, state legislation has been introduced (and in some states passed) which carries three main mandates: (a) that Braille will be taught to legally blind children, (b) that textbook publishers will provide the computer tapes of the texts in a timely manner for alternative media production, and (c) that teachers will be competent in Braille. The "Braille bills" can generate controversy among consumers and educators over such mandates that children with low vision be taught Braille. Nonetheless, consumers, parents, and professionals have been prompted to emphasize Braille literacy skills to ensure that people who are blind will have the skills to fulfill their potentials.

Questions and Answers about Braille Literacy for Rehabilitation Teachers

Question 1. What types of literacy situations might I encounter when teaching Braille?

The true answer is every type of situation imaginable but in general, literacy skills can be classified into five areas.

1. Adults who were illiterate sighted people, as clients they will need adult basic education in accessible media. Sometimes adults mistakenly think that they will learn to read as they learn Braille. It is important to keep in mind this rule: Instructors in adult basic education and literacy programs teach clients how to read; rehabilitation teachers teach clients Braille.

2. Adults who were functionally literate sighted people using visual cues and functional vocabulary words, as clients they will need reading skills with grade 1 Braille.

3. Adults who were literate sighted people, as clients they will need to maintain their literacy skills using Braille (grade 2) and other communication tools.

4. Adults who had limited education or who have had undiagnosed learning disabilities, as clients they will need adult basic education with grade 1 Braille.

5. Adults who are not English speakers with a range of literacy skills in their native languages, as clients they will need interpreters, English as a Second Language (ESL) courses, and literacy skills before they can successfully learn Braille.

Question 2. Are there a sufficient number and variety of Braille teaching texts available to meet the needs of all clients?

There are numerous Braille teaching texts available but there are gaps in the collection. For example, few texts have sufficient practice reading materials; teacher-made materials are necessary. This is particularly a problem for community-based itinerant clients who receive lessons weekly or less often. Second, few texts teach adults grade 1 Braille as basic Braille with appropriate language and reading levels. The term "basic Braille" means that grade 1 is all that the learner is going to learn now; it is not a prelude to grade 2 Braille. Third, few texts use daily living vocabulary words which would be both common to English speakers and helpful to ESL learners. Many texts do not use ordinary words in early units which will be contracted in later units; this can stifle the natural flow of language. It is more effective to teach the subject correctly the first time than to backtrack and reteach it correctly.

An excellent Braille text resource guide is soon to be published by the Association for Education and Rehabilitation of the Blind and Visually Impaired (AER). Cheryl Richesin, instructor in the Rehabilitation Teaching Program at Mohawk College (Brantford, Ontario, Canada) reviewed 19 major teaching texts and compiled the information into a 200 page *Rehabilitation Teaching Braille Textbook Review*. The *Textbook Review* was field tested by RTs in the United States and Canada. The *Textbook Review* provides information that RTs need to choose texts such as the sequence of teaching the Braille code, reading level, introduction of numbers, teacher manuals, number of pages and volumes, practice materials, etc.

Question 3. What guidelines should I follow for making Braille practice materials for clients?

The first issue is that the RT's Braille skills are sufficient to produce materials. Materials must be accurate, after all the purpose is to practice Braille correctly! If the RT's skills are not top-rated, find a transcriber or experienced Braillist to Braille the materials. Ask in the AER "RT NEWS" or the state AER Division 11 newsletter if other RTs have samples of practice materials or disks that they would lend for copies. Also ask the local consumer groups if they have suggestions or volunteers who would be willing to assist.

1. The practice learning material must pertain to the client's interests and reading level. The material should be at a level to confirm previous skills and challenge current skills. Braille practice materials should offer clients opportunities to read and write. After learning the alphabet, clients should be encouraged to write. The RT should review all practice material to catch errors and to give well-deserved praise.

2. The practice material should be timely and of value. Clients will not want to struggle to read last year's baseball scores/stories but might be interested in All-Star games or great moments in sports. Timely material of this sort can be used for other clients.

3. Practice materials which integrate content from other rehabilitation classes are particularly useful.

4. Practice material that clients can actually use, no matter the Braille contractions, is helpful and motivational. This can include labels for household items, names of family and friends, notes and directions.

5. Practice materials need to be durable. It would be ideal if clients had a paper copy and a Braillon copy to practice reading.

6. Practice materials should be labeled with dates so clients can mark Braille lesson progress, particularly learning grade 2.

7. RTs can also transcribe material that clients dictate (e.g., a recipe or verse).

Question 4. Where can I get information about Braille transcription services?

There are many resources for Braille transcription. Most Braille transcription is performed by NLS certified volunteers but Braille can also be transcribed using computer translation software with appropriate hardware by anyone trained to use the equipment and software. The per page and binding costs vary depending on the material to be Brailled, the turn-around time, and the volume of work to be done. The following resources are a beginning:

- The National Library Service, Library of Congress booklet *Volunteers Who Produce Books* (1-800-424-8567).

- The National Braille Association registry of Braillists and Braille technical code specialists (NBA, 3 Townline Rd., Rochester, NY 14623-2513).

• The Braille Literacy Mentor in Training Project *DOTS for Braille Literacy* newsletter has lists of transcription services (American Foundation for the Blind, 100 Peachtree St., Ste. 620, Atlanta, GA 30303).

• AFB *Directory of Services for Blind and Visually Impaired Persons in the United States and Canada* in the Directory section "Producers and Publishers of Braille and Other Alternate Media" listed for the United States and for Canada (American Foundation for the Blind, 11 Penn Plaza, Ste. 300, New York, NY 10001).

• The local special education/vision program service center, the state services for the blind, or the local private nonprofit agency for the blind.

Question 5. I have a limited budget for purchasing Braille textbooks. How should I choose the texts?

The agency should have at least two types of texts for teaching Braille: one text for teaching basic Braille grade 1 that presents the alphabet, number sign, and basic punctuation before introducing grade 2; and one text for clients learning grade 2. Use the Richesin *Rehabilitation Teaching Braille Textbook Review* to narrow down the choices. Ask other RTs in the area or state which texts they have found effective and borrow copies for review. Look for the following characteristics:

1. Braille readiness practice materials in the text.

2. Multiple reading levels to appeal to the largest number of clients.

3. Practice reading materials, especially if teaching Braille to community-based clients.

4. Check the sequence of Braille instruction so clients can learn (at least) basic Braille grade 1 and numbers before exiting rehabilitation services.

5. "Fast track" grade 2 Braille, a text that goes directly into grade 2 Braille for vocational clients.

6. Listing of Braille rules and contractions for client reference.

7. Writing exercises or any instructional material about writing Braille.

Question 6. What makes a "good" Braille teaching text?

The teacher must be familiar with the text and understand the lesson sequencing. It is conducive to good teaching if the RT agrees with the text format and philosophy. Clients must be able to relate to the content and language used in the text, of course knowing that a text is not recreational reading. The lesson format should consistently include review of previous material, a manageable amount of new material, and practice materials presented in each lesson. And obviously, the Braille dots should be crisp and clear on each page.

Question 7. How does teaching Braille to adults differ from teaching Braille to children?

The principles of adult education guide rehabilitation teaching instruction for all independent living areas:

1. Teachers are facilitators of the learning experiences with adults; adults are voluntary learners.

2. Adults bring a lifetime of valued experiences to the learning setting.

3. Adults learn in order to solve immediate problems: Motivation and usefulness of the knowledge are key to successful adult education.

4. Adults are self-directed learners.

Rehabilitation teachers provide instruction in the Braille code not in the process of reading. RTs can teach basic Braille (grade 1) as a total course without teaching grade 2 (Luxton, 1993). Most children who are Braille readers learn to read using grade 2 as their literacy skills develop. Special education vision teachers have specific training in assessment, evaluation, materials, and teaching methods for children.

Question 8. What models are currently used in the teaching of Braille reading to children?

According to Rex, Koenig, Wornsley, and Baker (1994) in *Foundations of Braille Literacy*, the current models are meaning-centered, skills-centered, and interactive. These models become approaches to teaching from which specific strategies are developed. Meaning-centered uses the reader's knowledge and experiences to determine or predict meaning from the text. Meaning-centered works well with adults. Probably all RTs have experienced teaching Braille to adults who say, "I cannot quite make out the dots, but it must say 'such and such'" based on the meaning of the sentence.

The skills-centered approach is based on decoding the symbols (Braille dots) into words and building words into sentences. This approach is used by clients who "sound out" the letters into the words. The interactive approach uses components of the meaning-centered and skills-centered approaches. It is the most applicable approach to adult learning. The authors of *Foundations of Braille Literacy* discuss the issues and research in literacy instruction for children who are blind or visually impaired but the information is also useful for rehabilitation teachers.

Question 9. What are learning styles for adults?

Learning styles are the ways that people organize and absorb knowledge, skills, and attitudes. There are many learning style inventories which involve aspects of cognitive, affective, and physiological factors of learning. Learning styles are a function of adult development and maturity; they may change over time. The teacher can create a variety of learning experiences to engage a client's learning style: individual teaching, group teaching, peer teaching, self-directed learning, home environment, agency environment, scheduling options, Braille text options, etc. Adults are diverse; learning activities must be diverse.

1. Does the client have the mental capacity for Braille, or does the client have short-term memory or perceptual problems?

2. Does the client have the physical capacity for Braille, the tactual ability in the fingers, the movement of the hands, the posture, and strength?

3. Does the client have support for learning Braille, belief in its value, or fear of failure or embarrassment if not successful?

Learning styles include aspects of motivation: Does the client respond to internal or external motivation? Adult education emphasizes that adults are active learners not just passive recipients. Is the client's style outgoing and active in groups or reflective and engaged in individual study? Learning styles include ways of thinking. Is the client analytical who likes to have everything planned or is the client situational who can respond to whatever is at hand? Learning styles also include visual and haptic learners. Visual learners can form and retain mental images; haptic learners prefer a hands-on approach and are generally skilled in mechanical domains.

Adults exhibit combinations of learning styles. RTs must understand learning styles and adjust their teaching methods appropriately. There are many fine texts, journals, professional groups, and courses in the area of adult education for RTs who have further interests in learning styles or adult education.

Question 10. What are the components of motivation that I can use with clients?

Motivation is a vast study unto itself but basically the energy of motivation is the individual's needs and values. Needs are more temporary than values. Values are the beliefs one holds and are stronger and more long-term than needs. When a need is met, the motivation for it decreases. Stresses arise when people's goals or actions are in conflict with their values. Clients are motivated to learn Braille based on their values or based on practical need. A client may want to learn Braille to read books because it is a valued activity, even if this goal does not seem to be attainable. The RT's job is to teach Braille reading skills, help the client learn as much Braille as possible during rehabilitation services, and leave the client with resources for continuing Braille study. Most clients learn Braille because of the practical need for tactual labeling and personal note-taking. For individuals who are blind, Braille is a means of communicating with oneself.

Clients can be motivated to continue their Braille studies by practice, supportive families, learning buddies, videos about Braille, reading books about people who are blind, attending consumer or support groups, optimistic and skilled teachers, and practical needs.

Question 11. Is it acceptable to use volunteers, family members, or assistants to assist in teaching Braille?

It is acceptable to use trained assistants to assist in the follow-up or support of Braille instruction, assuming that it is approved by the agency and the client. Assistants must be well-trained to know exactly what their roles are and to stay within those roles. Clients must also be willing to participate with a family member or neighbor assistant. The goal is to assist clients in gaining Braille literacy skills; therefore, the assistants must have literacy and Braille skills as well.

The RT is responsible for assessing clients, developing teaching plans, training the assistants, supervising the assistants, performing mid-term evaluations, and performing final evaluations. Projects using trained assistants are being conducted in the United States and Canada at the Canadian National Institute for the Blind (CNIB). RTs who are interested in these projects should inquire through AER Division 11 "RT NEWS" and at CNIB for details about training materials for their projects using literacy volunteers.

Adult education programs use trained assistants to teach or reinforce literacy skills. A major factor in helping adults learn is maintaining positive support (or at least neutral support) from family or friends. Trained assistants under the supervision of the RT can serve the dual role of supporter and facilitator of learning Braille literacy skills.

Question 12. Is it better to start teaching clients grade 1 or grade 2 Braille?

It is better by educational theory and practice to teach what the client will have success learning and will use. The client assessment should give a good direction for grade 1 or grade 2 based on the client's needs and goals. If clients are vocational candidates, young adults, or motivated older adults with good literacy and tactual abilities, then start with grade 2 Braille. Clients should understand that they are taking "advanced" Braille so that they are prepared to practice and study Braille. Clients must feel that the rewards are worth the time and effort involved.

Grade 1 basic Braille is perfectly legitimate to teach as a course of study for adult clients. Clients who begin with grade 1 can advance to grade 2. It is better for clients to learn grade 1 successfully and "graduate" to grade 2, than to begin with grade 2 and fall back to grade 1. The primary factors are motivation and use of Braille (Galbraith, 1991; Luxton, 1993).

Question 13. Clients complain that Braille reading is slow and they get frustrated. How can I help them?

Braille reading is slower than print reading and slower than aural reading. Braille readers average 90-120 words per minute; print readers average 200-300 words per minute; and aural reading can be over 300 words per minute with compressed speech (Berkowitz, Hiatt, de Toledo, Shapiro, & Lurie, 1979). New clients do not read Braille quickly; Bruteig (1987) found readers to be "fast" at 40-70 words per minute and Johnson (1989) found some clients reading at 10 words per minute at the completion of training.

This is not to discourage Braille instruction but it is to show that Braille reading is one of the adaptive communication tools that clients can learn to use. RTs can help clients use the right communication tools for the right tasks in the right situation.

Clients should know at the start of Braille instruction that Braille reading is not as fast as print reading. Nevertheless, the study of Braille will bring the benefit of having an accessible personal communication medium.

Techniques for increasing reading speed include practice, materials of interest, appropriate reading level, reading aloud by the RT with the client following, proper hand positioning and two-handed reading, crisp Braille dots, supportive network, learning buddy who is progressing at a similar or slightly quicker pace, and skilled teachers. For some clients, reading aloud is helpful because it encourages them to keep the flow of language. For other clients, reading silently and then discussing what they have read helps them focus on the meaning of the passage.

Question 14. What are the physical aspects of learning Braille that I should keep in mind when working with clients?

There are four main points to discuss with new Braille learners:

1. Reading Braille is a dynamic process whereas reading print is static. Braille is read by the movement of the fingers over the dots and print is read by the eye focusing on words. If the finger rests on Braille cells, information is not perceived and reading is halted. Conversely, if the eye moves too much and does not focus, words blur.

2. Reading Braille is generally a two-handed process. Both hands are used for reading, tracking, and marking lines as well as reading with increased speed.

3. Braille reading demands a light touch using all of the fingers. Many clients will begin feeling Braille by pushing it down, scrubbing across it, and sometimes even going in circles over it. Clients should be taught that a light horizontal movement is the most efficient way of reading. Emphasizing a light touch may encourage clients to read with more than one finger or at least to be able to use other fingers for back-up reading.

4. New clients may be tired from the physical movement and strain of reading Braille. Clients find that holding the book in the proper position aligned squarely with the body, holding the fingers slightly curved, and using the trailing hand for tracking are physically tiring movements. Clients also tend to hunch over Braille as though they were looking at it and this causes neck and upper back strain. Also, clients usually need to "shake out" their hands and stretch their fingers.

Question 15. I work with clients who cannot or will not use Braille but need tactual labeling. What else is available?

The answer to this question is more than finding other tactual labeling systems. It is important to know whether clients cannot physically use Braille or are unwilling to use Braille. The following affective components of the teaching and learning situation are very real and must be approached with understanding:

1. Listen to what the client says. Does Braille give the client a negative feeling and make the client "feel blind?" Is the client fearful or embarrassed of failure?

2. Is the client capable of reading or does the client have low literacy skills? If the client has low literacy skills, what have been the "school" experiences?

3. Is the client ready for rehabilitation and learning to be independent using Braille or another tactual system?

4. Does the client think that Braille is worthwhile?

If the client is willing to learn, then assess for tactual abilities and goals. Braille is useful for its versatility so the assessment has to be clear about the problems to be solved:

1. Assess clients to determine whether jumbo or enlarged Braille could be used. "Jumbo" Braille varies in dot size and matrix spacing; it is not standardized as is regular Braille. Pester, Petrosko, and Poppe (1994) found no significant differences for accuracy between regular Braille and enlarged matrix regular dot size Braille reading among adults. Many clients report that they are able to feel larger Braille more easily than regular Braille, which may result from slightly larger dot size and enlarged matrix. When writing Braille, try extra spaces between the cells so clients have a mini-stretch break before the next cell. Also try writing the Braille on plastic like talking book magazine records, using the 3-M Dymotape labeler, and using the slate in order to make sharper dots.

2. If clients cannot distinguish the dots, try an alternative tactual system such as Fishburne. Fishburne is a code composed of embossed straight lines in patterns signifying letters of the alphabet. It can be written using the Fishburne labeler. Reading materials are not published in Fishburne.

3. Moon Type embossed print is used more frequently in Canada than in the United States. It is composed of nine basic shapes and can be written by hand on Braillon. Clients who learn Moon can continue their studies in Braille. Books, magazines, and other items are produced in Moon by the Royal National Institute for the Blind in England.

4. If clients do not have the need to perform tactual note-taking, then there are innumerable tactual labeling systems that are developed for individual clients. The basic guideline is make it work for the client.

Question 16. The family wants the client to learn Braille but the client refuses. What should I do?

There may be all kinds of issues going on here and Braille may be the proverbial "tip of the iceberg." Keep in mind that the client is the learner and will not learn if not motivated. The client has the options and the RT's job is to help the client make informed choices about those options.

Talk with the family and client to hear the issues. Explain to the family the role of the RT and the role of Braille. Decide whether the family issues are of such complexity that a social worker or counselor is needed. Determine whether rehabilitation teaching and Braille instruction can take place in that setting. If the home life is not conducive to teaching, are other settings available for the client? If the family is negative or hostile, can teaching and learning take place in that setting? Can teaching take place concurrent with family counseling, if necessary? Is the client resisting Braille as a sign of resisting rehabilitation?

Assess the client to determine the client's needs and goals which will indicate whether or not Braille is appropriate. Develop the teaching plan and discuss it with the client and family. By this time, the issues over learning Braille should be resolved or in the process of resolution in order for teaching to begin. The family definitely has a role with the rehabilitation; hopefully it will be a positive role.

Question 17. When should I teach Braille writing skills?

Begin to teach Braille writing as soon as possible. Clients need materials to practice reading that are useful and of interest to them. Many RTs wait until the client is able to read the alphabet before teaching writing and clients may not get enough practice to be confident and accurate in Brailling. Each lesson should contain some writing skills. Clients can begin writing names and numbers or Brailling playing cards as soon as they have learned the numbers. Clients should have experience using a Brailler and a slate and stylus. Most clients will write with a slate or stylus or 3-M labelers but they should know what is available.

Question 18. What are some of the activities or resources that have been created for the Braille literacy movement?

The best ways to keep up with the activities and resources in Braille literacy that pertain to your teaching include: the *Journal of Visual Impairment and Blindness*, the AER journal *RE:view*, the AER Division newsletters, newsletters from other agencies and consumer groups, and read catalogs such as *Exceptional Teaching Aids, Inc.* Also attend conferences, talk with other professionals and consumers, and contribute your ideas to all of these sources!

The Braille literacy movement has generated research, numerous publications and books, two national conferences of "Getting In Touch with Literacy," the AFB Braille Mentor Network, the Rehabilitation Teaching Textbook Review, statewide Braille bills for textbook production, the NLS Braille competency test for teachers, the Uniform Braille Code movement, public education materials celebrating Louis Braille's birthday, videos about Braille and Braille teaching, technology such as computer-driven Braille note-takers, and increased enthusiasm for Braille!

References

Berkowitz, M., Hiatt, L. G., de Toldeo, P., Shapiro, J., & Lurie, M. (1979). *A survey to determine the extent of the eligible user population not currently being served or not aware of the programs of the Library of Congress national library services for the blind and physically handicapped* (Vols. 1-5). New York: American Foundation for the Blind.

Bogart, D. E. (1991). Report on international Braille conference. *Journal of Visual Impairment and Blindness, 85*, 234-235.

The Braille centenary--1929. (1929). London: National Institute for the Blind.

Bruteig, J. M. (1987). The reading rates for contracted and uncontracted Braille of blind Norwegian adults. *Journal of Visual Impairment and Blindness, 81*, 19-23.

The Canadian National Institute for the Blind. (1996). *A guide to Braille literacy*: Author.

Galbraith, M. W. (Ed.). (1991). *Facilitating adult learning*. Malabar, FL: Kreiger.

Irwin, R. B. (1955). *As I saw it*. New York: American Foundation for the Blind.

Johnson, L. (1989). The importance of Braille for adults [Letter to the editor]. *Journal of Visual Impairment and Blindness, 83*, 285, 287.

Koenig, A. J. (1992). A framework for understanding the literacy of individuals with visual impairments. *Journal of Visual Impairment and Blindness, 86*, 277-284.

Luxton, H. L. (1993). Factors affecting rehabilitation teachers' Braille instruction of adults who are blind and visually impaired. *Dissertation Abstracts International, 54*, O3A. (Columbia University).

Pester, E. J., Petrosko, J. M., & Poppe, K. J. (1994). Optimum size and spacing for introducing blind adults to the Braille code. *RE:view, 26*(1), 15-22.

Rex, E. J., Koenig, A. J., Wornsley, D. P., & Baker, R. L. (1994). *Foundations of Braille literacy*. New York: American Foundation for the Blind.

Richesin, C. (In press). *Rehabilitation teaching Braille textbook review.* Alexandria, VA: Association for Education and Rehabilitation of the Blind and Visually Impaired.

That all may read library service for blind and physically handicapped people. (1983). Washington, DC: National Library Service for the Blind and Physically Handicapped Library of Congress.

Training for Reading with Low Vision

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Introduction

The purpose of this manual is to provide the reader with access to the available information on teaching people with low vision how to read using optical devices. The intended audience is those who are, or will be, working directly with this population and have as their goal the increased reading ability of the client/patient/student.

There are several assumptions that are made and must be presented here. First of all, it is assumed that the client will have had a thorough low vision evaluation by trained professionals. This should include an ocular health exam, refraction (checking for glasses), visual field testing, and determination of magnification needs. Secondly, it is assumed that the would-be reader is an adult who already knows how to read but has lost this ability due to a vision impairment. Finally, it is assumed that the primary impairment to reading is the vision impairment and not a cognitive or perceptual difficulty. Although some of these techniques may prove to be effective for individuals with brain injuries, it is not the purpose or scope of this manual to address the unique needs of this population.

Depending upon the domain of the service provider, the person with low vision may be identified as the patient, the consumer, the client, or the student. In this manual, the term "client" will be used to mean any of those mentioned.

The books and articles listed in the annotated bibliography do not include those that are out of print or are not available in English.

Why Train Individuals with Low Vision Reading with Optical Devices?

For the adult who had good eyesight all of his or her life, the task of learning to read again can be overwhelming. Often faced with the multiple impairments associated with aging (including sensory impairments and neuromuscular limitations), the older adult must also contend with the psychosocial and emotional adjustments to vision loss. These processes may serve to further cloud the client's ability to understand the tasks associated with learning to read with low vision devices. In fact, the very presence of vision loss can inhibit the client's learning through the conventional "pencil and paper" methods that might be used in a conventional clinical setting. While explaining how to use a low vision device may be more effective than saying nothing, instruction in reading with the device has been shown to be far more effective.

The benefit of instruction in the use of low vision devices and more efficient use of residual vision to improve reading speed and duration is a documented fact. In 1977, Goodrich, Mehr, Quillman, Shaw, and Wiley measured the reading speeds of 24 low vision subjects who were divided into CCTV users and non-CCTV users and enrolled in a 10-day training program. They found that "performance will increase with practice and training". Goodrich and Quillman (1977) described the efficacy of teaching clients with low vision how to use their peripheral vision through the use of eccentric vision. In 1990, Nilsson found that formal training in the use of devices and residual vision ... is far more effective than mere instruction in restoring visual performance in practical situations. Nilsson and Nilsson (1994) looked at adults with severe macular degeneration. Their study showed that "improvements in acuity do not guarantee improvements in visual performance in real life and that formal educational training is far superior to mere instruction regarding successful results of visual rehabilitation".

But knowledge of the effectiveness of training is only part of the solution. A curriculum for training and a set of training materials are also needed. The first and one of the only, widely published manuals to specifically itemize the steps in the near vision training program and to provide exercises for the client was *Low Vision Training* by Backman and Inde (1979), now out of print. This deficiency has been recently filled by the *LUV Reading Series* by Wright and Watson (1995), a series of graduated exercises that integrate the principles of learning to read with those of near vision training.

The field of health care is changing and there are increasing numbers of providers of low vision services whose backgrounds are outside of eye care and rehabilitation and/or education of people with vision impairments. This is spurred in part by the realization that there are increasing numbers of older people who are visually impaired. It is hoped that, given the evidence and the newly published resources cited above, the low vision practitioner who is not familiar with techniques for teaching reading with optical devices will see the need and the methods for doing so.

Low Vision Device Instructional Manual

Low vision devices for reading can be categorized as either optical (utilizes a lens or lenses) or non-optical (no lens or lenses utilized); each of these two major divisions can be further sub-divided into more specific groupings. The selection of the particular device(s) for a client will depend upon many factors, and part of the role of the low vision therapist is to match the client's goals and abilities with the appropriate device. The following list of low vision device categories is designed to help the practitioner determine the best place to begin given the goals and abilities.

Handheld magnifiers. These devices are usually the low vision device that is most familiar to the client. In the lower powers (up to 3x to 4x or +12.00 D. to +16.00 D.) they are relatively easy to use. Most clients come to low vision training already familiar with these devices. In addition, they are usually inexpensive and easy to obtain. The limitations of these devices include the need for a steady hand with the necessary endurance to hold the lens at the proper focal distance from the desired material. As the hand tires and the lens moves closer or further from the page, the print will become smaller and, therefore, less readable. Although these lenses can provide a relatively normal working distance, the very fact that they are usually held at some distance from the eyes often means that the field of view (i.e., how much can be seen at one time) is limited. In the higher powers (above 4x or +16.00 D.), the need to hold the magnifier at the proper focal distance can be too demanding for many clients, particularly those who are elderly. Lighting may be provided as a part of the magnifier or may be added from an outside light source. The light should be directed so that the amount of reflection on the lens is minimized.

Stand magnifiers. A handheld magnifier with legs or a base offer the advantage of allowing the user to rest the lens (or its base) on the reading material instead of maintaining the best focal distance by holding the device. As with the handheld magnifiers, this device can be used at a conventional distance from the eyes. However, as the power of the lens increases, the device must be brought closer to the eye to achieve focus and maximum field of view. Most older users will need to wear their age appropriate reading correction to do this. Increased illumination is also important to consider and usually necessary. Therefore, stand magnifiers with lights are often more beneficial than those without.

Head borne and spectacle-mounted loupes. In many cases, these are leftovers from the days when all low vision devices were taken from the available industrial and hobby markets. Often small, lightweight, and inexpensive, clip-on loupes may strike a chord with males who view thick glasses as "wimpy", but see these devices as a part of "male culture" (i.e., gunsmithing, fly tying, watch repair). The usually limited lens area and the difficulty that some users have in aligning their vision with the loupe can make this device difficult to use for long-term reading. Nevertheless, there is a significant advantage for some users in being able to switch back and forth quickly between a magnified and non-magnified view of their work.

Reading glasses. Sometimes called "microscopes", "microscopics", or "high-plus readers", reading glasses offer the convenience of a head-borne device (hands free to hold reading material) and offer the widest field of view of any of the optical devices. This occurs because the lens is positioned close to the eye. On the other hand, many clients are resistant to using a device that may have a very reduced working distance. With handheld magnifiers, users need to hold the lens at a specific distance from the page to obtain optimal magnification; with reading glasses, the reader must hold the print at a specific distance from the glasses for the same reason. This can be tiring for some and uncomfortable for others. Reading glasses can be provided as full-field lenses (the reading correction is in the whole lens and the glasses must be removed in order to see other things at greater distances), half-eyes (allows the user to look over the top of the lenses when not reading), or in multi-focal lenses (bifocals or trifocals). This latter arrangement allows the user to wear only one pair of glasses for most activities.

Telemicroscopes. These can provide an increased magnification for reading while allowing the client to hold or place the material at a more conventional working distance. This is especially helpful for those who cannot adjust to severely reduced working distances and for activities such as reading music or a computer monitor. The limitations of telemicroscopes include the need to hold the head and the reading material very still; maintaining a constant focal distance; and a reduced field of view, especially in the higher powers of magnification.

Closed-circuit television (CCTV). This electronic magnification device allows clients to have variable magnification, control of brightness and contrast; the ability to reverse the polarity of the image (i.e., white on black or black on white); and a conventional working distance. The field of view is comparatively wide, and the magnification potential extends up to 60x in some cases. There are a wide variety of manufacturers and models to choose from and prices will vary with the number of features on a particular machine and whether or not on-site service after the sale is included. The standard, console-type model is limited in its portability, although there are various sizes of units and some manufacturers offer more portable models.

Before Training Begins

It is vitally important that a client with low vision have a basic understanding of the disease process and the functional implications before beginning the training process. Many older people believe that using their vision will hasten its decline and, therefore, may harbor a reluctance to use low vision devices. Given that the concept of "sight saving" was considered scientifically valid in the 1950s, a typical 70- or 80-year-old may still remember some of what he or she picked up about this topic. If the patient's low vision is due to a disease over which he or she had no ability to control, it may help to point this out. It is a typical human response to look for a tangible cause to explain an otherwise unexplainable event.

If possible, offer or reinforce a prognosis for the disease based upon the diagnosis (e.g., "you will not become completely blind from macular degeneration"); it may be helpful to do so. Even if the prognosis is poor, as in retinitis pigmentosa for example, pointing out the uncertainty of the rate of progression may help to dispel the client's perception that there is no point in learning new low vision skills because he/she will "be blind tomorrow". Remember that the client is often dealing with two separate disabilities: the loss of functional visual abilities and the uncertainty of the prognosis. Whenever possible, help those with a more certain prognosis to understand this feature of the disease; for those with an uncertain prognosis, help them to understand this as a separate disability that may be dealt with separately.

It is also helpful to validate for the client what he or she has experienced. To the experienced low vision practitioner, it may seem too basic to point out that one's vision may be blurrier for some time after instilling eye drops to treat glaucoma, but it may not have occurred to the client that this is a virtually universal experience. Likewise, a client who is experiencing changes in visual ability due to changes in lighting may benefit by having that knowledge validated and reinforced. Rewarding and reinforcing knowledge that the client has already gained on his or her own may help to encourage more experimentation and exploration. It may also improve the skills of the practitioner as he or she will be able to learn from the experiences of the clients if he or she is a good listener.

The client with low vision needs to understand the basic functional limitations imposed by the eye disease. For example, understanding the presence and impact of a central scotoma is essential for a person with that condition. Some clients may feel that it is "cheating" to use their side (peripheral) vision through eccentric viewing. They must be shown that rather than "cheating", it is virtually the only way that they will see. In a similar way, clients with a peripheral field loss may not be aware of the impact that looking through a small central field will have on their ability to perform a specific task. Again, explaining this to the client may validate what he or she already thinks or senses. Other common misconceptions that should be discussed at the beginning of training are discussed below.

"Stronger glasses". Generally, this phrase comes up in the context of a client asking for a new refractive correction that will make everything clear again. It may help to inform clients that this is not possible (if, in fact, this has been evaluated by their eye care practitioner and is so). Assure clients that although there may not be stronger glasses to make everything clear again, you will help them find the various new tools that will help them get the most out of their vision.

One tool will solve everything. Similar to the stronger glasses issue above, many clients are looking for just one low vision device that will be effective across all environments. This makes sense for an older person who has used multi-focal lenses for many years and has actually experienced one tool solving everything. However, with low vision, the rules of the game have changed. It will help to inform the client that each of his or her needs will be addressed, but that it will probably require different tools for different jobs. Dr. Tracy Williams of the Deicke Center for Visual Rehabilitation in Wheaton, IL tells his patients to think of their low vision devices as tools in a tool kit. There are different tools for different jobs, and no one tool will do everything.

The Chief Concern

Perhaps the most important piece of information for the practitioner to gather is the client's chief concern. In other words, what do they want from low vision rehabilitation? It is usually helpful to discuss this at the beginning of the process so that all parties are focused on the same goal.

Specificity of purpose is important, too. For example, the goal of "reading" should be further defined to reading specific types of materials. Reading the mail, reading a large print book, and reading a price tag in a store are all very different tasks which may be solved with different tools. By identifying exactly what it is that the client wants to read, one will have also come up with an appropriate source of motivation for training. If a client states that she wants to read the newspaper, the practitioner should explore this in greater detail. Problems may be encountered in training if it is assumed that she wants to read the fashion news when her primary interests are the sports pages and the stock market.

In some cases, the goal may be achieved by not reading. For example, if the goal is reading the phone book, it might be more easily managed by suggesting to the client that he or she conserve the energy available for reading by calling directory assistance instead. The practitioner can offer to provide him or her with a form that exempts the client from charges for these services.

Once the appropriate amount of magnification has been determined and the client's refractive error has been considered, the clinician should consider the pros and cons of each low vision device "delivery system". For example, to determine if the required magnification be provided in a handheld or head-mounted device, one might ask the following questions:

1. **Is the client more interested in cosmetic acceptability than an increased working distance?**

> Are there other disabilities such as neuromuscular or orthopedic impairments that may preclude the effective use of a particular type of device?

2. **Has the client successfully used a particular type of low vision device in the past and does she indicate that she is comfortable using it?**

Although it is possible for the practitioner to make a choice of which type of low vision device the client will use, it is preferable to involve the client in the decision- making (when he or she is capable of making decisions). Although this process may be more time-consuming, it will help to empower the client and give him or her more responsibility in the rehabilitation process. This, in turn, may help to make the client feel more involved in the process and less like a "passenger along for the ride".

Training for Reading

The writing of Gale Watson and Vicki Berg in *Understanding Low Vision* (1983) stands as the most complete single work on the topic of near vision training. There are no other known works of equivalent scope and detail which could be synthesized into a new, more complete document. Given this situation, it did not seem reasonable to try and re-write their work with the goal of having it "sound" different but remain factually the same. The American Foundation for the Blind was gracious enough to permit the inclusion of a portion of the material in that chapter.

Materials from *Understanding Low Vision* (1983) have been reprinted with permission from the American Foundation for the Blind.

Suggested Sequence for Training

I. Preparation for Training
   A. Assembling information about a student
   B. Making a tentative outline for training
   C. Preparing the environment
   D. Gathering materials

II. The Initial Encounter: Discussion
   A. Establishment of objectives for the use of aids and priorities among them
   B. Current level of performance of tasks
   C. Present use of aids
   D. Student's understanding of vision and its functional implications
   E. The clinical examination
   F. Preferred illumination

III. Presentation of Low Vision Aids
   A. The student examines the aids tactually and visually
   B. The instructor describes the aids, their uses, advantages, limitations, and how to take care of them

IV. Efficient Use of Visual Skills Without Aids
   A. Fixation
   B. Eccentric viewing (if necessary)
   C. Localization
   D. Scanning
   E. Tracking

V. Efficient Use of Visual Skills with Aids
   A. Focal distance, field of view of the aid
   B. Localization
   C. Scanning
   D. Fixation, eccentric viewing
   E. Tracking

VI. Performing Specific Tasks with an Aid
   A. Establish a performance baseline with and without the aid
   B. Analysis of tasks
   C. Problem-solving
   1. Determine the problem
   2. Explore the options for treatment

VII. Termination of Training
   A. The student reaches the desired goal
   B. The student reaches a level where the goal can be pursued through practice without the instructor
   C. The student reaches a plateau; further instruction is not helpful

VIII. Follow-up
   A. The student is telephoned or visited
   B. The student returns to the instruction site where skills are demonstrated with aids
   1. Skills are satisfactory
   2. Skills are not satisfactory

IX. Returning to Training
   A. A problem is identified with which instructor can help
   B. The student has a change in vision or a change in goals or new aids. Repeat sequence, if necessary.

Preparations for Training

Assembling Information

The utilization of residual vision encompasses all facets of a student's life: personality, intelligence, type of vision loss, education, vocation, peers, family, and the community. Each component contributes to the achievement of or the failure to achieve visual goals. The probability of amassing copious amounts of information in each of these areas is slim. However, the wise instructor will be on the lookout for information about the student in each of these areas. The first places to took for such information are the records or reports of other professionals. The types of information that may be found are listed below.

Vision loss. The type and severity of the vision loss and the actual disease, disorder, or anomaly will suggest certain functional information. For example, macular degeneration usually is accompanied by central scotomas, whereas retinitis pigmentosa frequently causes restricted fields. The visual acuities obtained will suggest what size target may be seen at what distance.

Refractive error. Students who are hyperopic or myopic may need to wear eyeglasses to correct their condition. Students who are myopic often can view near tasks at a close distance with greater ease if they take off their glasses. This "built-in" magnification will not harm the eyes; if it is strong enough, it will be more convenient than using an optical aid with the spectacle correction. If the built-in magnification is not enough, the optometrist or ophthalmologist probably will prescribe additional magnification. Myopic students will need to wear prescription glasses for distance tasks. The presence of hyperopia and myopia will change the focal distance of an optical aid unless the prescription for the refractive error is incorporated into the aid.

Cylindrical correction. Students who require cylindrical correction may need to wear this correction in a pair of eyeglasses. If the correction is extensive, it may need to be incorporated into the optical aids for a clear image.

Onset of the visual impairment. If the onset is recent, students may have psychosocial problems that outweigh the optical problems. Generally, the more long-standing the vision loss, the more ready the student is for visual education and rehabilitation. Students with a severe congenital visual loss may experience some delay in conceptual and perceptual development.

Level of general health. The training program may need to be modified to avoid fatigue or other specific problems depending on whether a student has other physical impairments.

Medications. Blurred vision, fluctuating vision, and photophobia are side effects of medications that may affect the student's ability to use vision. The *Physician's Desk Reference* includes useful information on the visual side effects of medications.

Education. Generally, the more education and experience a student has, the more specific the student will be in establishing goals and in communicating.

Employment. The desire to obtain or remain in a job can lead to specific goals and often is a source of motivation.

Leisure activities. Hobbies and social and recreational activities are indicators of a high quality of life. These activities also can lead to specific goals, are a source of motivation, and provide opportunities to use residual vision in a more relaxed atmosphere.

Previous use of low vision aids. If a student is using low vision aids successfully, then the student has demonstrated a desire and ability to maximize vision. If previous attempts to use low vision aids were unsuccessful, it is imperative to prescribe aids and design a program that increases the chances for success by taking this into consideration.

Present level of skills. If the student is performing a desired task even to a minimal extent, it shows a strong desire to remain visually active. It also may be an indication of refined visual skills and the easy acceptance of low vision aids.

Environmental considerations. A student's use of vision may be inhibited by some aspect of the environment such as insufficient illumination, which the student is unable to control.

Psychosocial considerations. Consultation with a counselor, social worker, or psychologist may reveal insights into the student's motivation for using vision. Psychosocial problems may inhibit the effective use of vision in some students but they may spur other students to achieve.

Clinical data. The results of the clinical evaluation with an optical aid will give the instructor an idea of the student's ability to use residual vision. For example, a 4x magnifying lens that gives only a 2x increase in acuity may indicate the need for training in eccentric viewing, a change in illumination, or a lack of motivation to achieve. Whatever the difficulty, a well-designed training program can help discover and solve it. The clinical report indicates the position of the field loss or scotoma and thus allows the instructor to predict potential problem areas. It also describes the type, size, magnification, focal distance, and objectives of the optical aids that have been prescribed for or lent to the student. It also indicates whether a regular spectacle correction improves the student's vision and when and under what circumstances it should be worn. Answers to the following questions may be found in the clinical report as well: Does the low vision aid prescribed by the clinician meet the student's expectations? Why did the clinician prescribe the needed amount of magnification in the chosen design (i.e., a telemicroscope versus a microscope)? Is it necessary to patch the eye not being used? Which target and of what size did the student see with the aid? What type of material (i.e., letter, number, word, paragraph, symbol) did the student recognize? What were the clinician's recommendations for teaching the use of the aid?

Preparing the Environment and Gathering Materials

Training takes place in various environments. Some students receive training in the clinical setting in which the optical aid was prescribed; others work at home or in a school, vocational, or other setting. Wherever training takes place, the instructor should be able to control the illumination, provide postural comfort, and have available a variety of optical and nonoptical aids and other materials that are needed to complete tasks and maintain uninterrupted sessions.

Illumination control may be provided by draperies or shades on windows; rheostats on overhead lights; a variety of flex-arm or goose-neck lamps with incandescent, fluorescent, and high-intensity bulbs; colored filters; tinted lenses; visors; temple and forehead shields for spectacles; and pinhole patches. A light meter should be used to measure the light preferred by the student. This preferred lighting should be noted and duplicated at subsequent training sessions.

The Initial Encounter

In the first session, the instructor introduces himself or herself and, in general, tries to make the student feel comfortable. Then the instructor asks the student and family about the student's goals for near training. Although these questions may seem redundant, they will help the student to be more specific and to establish priorities among multiple goals. Thus, even though the student may have been prescribed aids for reading and writing, he or she will need help in deciding the specific tasks to be performed and in determining which tasks are most important. For example, reading grocery prices is a different task from reading a newspaper, and signing one's name on a check is different from writing a letter.

The instructor also asks about which tasks the student is currently performing and at what level, whether the tasks were performed in the past, and, if so, how long ago they were performed. The purpose of these questions is to establish a point of entry into training. The appropriate entry point allows the student to achieve success in a task, yet is difficult enough to present some challenge. If the entry point is too easy, the instructor will move forward quickly; if it is too difficult, the instructor will drop back to an easier level.

The clinician's examination is the next topic of discussion. When appropriate, the instructor and student should discuss the student's acuity, fields, pathology, and prescriptions. The instructor may have to translate the technical terms into more commonly understood language for the student. In addition, the instructor may compare the functional implications of acuities and fields with what the student feels about his or her condition. However, the instructor must make sure that his or her descriptions are consistent with those of the clinician.

The involvement of family members and peers in explanations, discussions, and training can be helpful. These persons provide an excellent support system and can assist the student to practice at home and in school. They often hear and remember what the student does not. If there is tension between the student and significant others, however, the student should work alone.

The next topic of discussion is illumination. The instructor should find out if the student prefers bright or dim light and under what circumstances. The instructor should also determine whether the student's lighting needs fluctuate from day to day or from morning to afternoon, and if the student is bothered by glare and in what places. If training does not occur in the environment in which the aid will be used, the instructor should question the student about the lighting in the actual environment.

General Guidelines for Training

In developing an instructional program, the following general guidelines should be observed. First, the training environment should be as relaxed as possible. The instructor should look for signs of stress, fatigue, or withdrawal in the student. Clenched fists, shallow breathing, confusion, stammering, nervous laughter, sighing, tight shoulder or neck muscles, slumping, and mumbling are indications that the student is tense and not ready to begin training. Gently calling attention to these signs of stress may help alleviate them but in some circumstances, pointing them out may make the student more tense. The instructor may decide to shorten the session, work on easier tasks, delay the session until another time, or consult with other professionals if the student's level of stress does not abate.

Second, the initial tasks should be easy enough for success and challenging enough to hold the student's interest. Visual tasks with high contrast and little or no figure-ground confusion are the best types of task in the beginning. Thus, modification of activities to meet the needs of the student is always necessary.

Third, the training sequence always should be flexible enough to meet the demands of the individual student. For example, physical disabilities that may inhibit the performance of a task should be identified and the task should be altered so success can be achieved. For example, a student with cerebral palsy who has hand tremors may have great difficulty maneuvering a stand magnifier for reading. Use of a microscopic spectacle with a reading stand will minimize the involvement of the hands in this task.

Fourth, shorter sessions interspersed with periods of discussion are helpful. As the student becomes more proficient, he or she will be able to view comfortably for longer periods and with less fatigue.

Fifth, frequent communication with other members of the low vision team will enable all team members to lend their expertise fully at key times. A knotty problem with a student's use of vision or aids is best solved when the team works together.

Efficient Use of Visual Skills Without Aids

The efficiency with which a student is using vision can be a predictor of future success with aids. That is, students who utilize more vision without an aid find it easier to incorporate aids into the performance of visual tasks. However, some students compensate so well with their visual skills that they may at first be slowed down by the optical aid or consider it to be too much "trouble". Some students hardly use their vision; because they have encountered environmental or psychosocial difficulties or never learned certain visual skills, they rely on other modalities or on sighted helpers. If the instructor is familiar with the student's visual skills without optical aids, he or she will be able to understand and resolve difficulties that might occur with the aids, plan a more precise program for the use of low vision aids, enable the student to increase awareness of how he or she is using vision, and increase the student's efficiency without aids. Some excellent drills in the use of visual skills for reading may be found in two manuals on low vision training by Backman and Inde (1979) and Quillman (no date) (Editor's Note: Both of these manuals are out of print).

The visual skills needed for near tasks are as follows:

1. Fixation or "fixing" the target in the area of clearest vision so it can be

recognized with the greatest detail.
2. Localization or finding the target by shifting the area of clearest vision to the area where the target appears.
3. Scanning or shifting the area of clearest vision back and forth in an established pattern to find a target or identify rows of targets.
4. Tracking or following a moving target.

Fixation

Fixation is difficult for students who do not have foveal vision and must move a scotoma or blind spot to one side to use the area of clearest vision. The difficulty arises when the student attempts to "see" with the foveal area but notices the targets on either side of the scotoma, missing the one in the middle. A student often has this problem if he or she skips and mis-calls letters and small words when attempting to read. To teach the student what portion of the field of view to use, the portion not to be used must be taught first. Some students who experience problems with this field of view are often unaware of the central scotoma and must be made aware of it by using the following demonstration of eccentric viewing:

1. The eye not being used should be patched.
2. The instructor's face should be appropriately illuminated.
3. The instructor tells the student to look without moving the eye, at the instructor's face directly in front and approximately 1½ feet away.
4. The instructor says, "When you look at my face, some portion of it will appear unclear or missing. Can you tell me which area?"

The student's response will be subjective. The instructor should note where his or her reflection fell in the student's eye. If the reflection fell in the center of the student's pupil, the student will probably report that some part of the instructor's face was unclear or missing. If the reflection fell in some quadrant of the pupil, the student may report no unclear or missing areas because he or she already was viewing eccentrically; in such a case, the instructor should ask the student to repeat the task and center the face.

After the student notices what part of the face is missing, the instructor asks the student to move the eye in different directions to clear the face (i.e., look to the right ear, to the left ear, to the top of the head, and to the chin of the instructor).

The instructor directs the student to shift only the eye (not the head or body) to see the instructor's face most clearly. (This type of shifting will be necessary to look through the optical center of the lens of a low vision aid.)

Students whose widest field of view is vertical rather than horizontal (e.g., those with hemianopsia, scattered scotomas, or central scotomas in combination with restricted fields) always find eccentric viewing with a head movement easier than with an eye movement. Tilting the head and cyclorotating the eye can widen the horizontal field of view and make the target easier to localize and scan. It may be helpful for these students to tilt the target in the appropriate direction and keep their head in an upright position or use some type of low vision aid that permits the head to stay erect.

The skills learned in the previous steps may be transferred to viewing a symbol printed in a recognizable size on an index card. The student should repeat the procedure used with the face and compare the area of vision used to view the symbol with the area used to view the face. Was the same area used to view both targets? If not, the student should repeat these tasks to find out why.

Students with central scotomas and restricted fields, scattered scotomas, or only a small off-foveal area of vision may not be able to hold the area of clearest vision long enough to perform these tasks. For the eye being tested, the instructor provides a patch with a small aperture (2 to 5 cm) to be placed over the eye and tells the student to move it into the position where the symbol on the card can best be seen through the aperture. Because the aperture is placed close to the area of clearest vision, any wandering eye movements will cause all vision to blur or blank out. This all-or-nothing technique provides the student with reinforcement for holding the eye in the correct position. The instructor should record with a stopwatch how long the student can maintain the target image through the aperture. As practice progresses, the student may show a dramatic increase in the length of fixation. Eventually, the aperture can be made larger; it can be removed when the student habitually maintains the correct gaze. Increasing the size of the target also helps the student to fixate.

Localization

Localization is necessary for finding the beginning of a page and for reading an article or diagram. Other tasks that require localization include searching for key words such as those at the top of a page of a dictionary or telephone book, the price of a grocery item, the amount to be paid on a telephone bill, and picking up a dropped stitch in crocheting or knitting. These exercises may be helpful in checking a student's localization skills:

> The instructor gives the student a page of recognizable single letters, numbers, or other symbols and asks the student to find the top-left symbol, the bottom-right symbol, a symbol close to the middle of the page, a symbol in each quadrant of the page, and so forth. The instructor checks the student's directionality. Does the student mix up left and right or top and bottom? When looking at the middle, is the student off center? Does the student use the upper-left and bottom-right corners and margins as guides to find symbols in those corners?

If the previous task was too difficult, the instructor places several rows of small objects on a table and asks the student to perform the same exercise with these objects.

In both these exercises, the instructor observes the student's posture and the position of the body, the head, and the eyes and provides the optimal illumination and contrast.

Scanning

Scanning is used for reading one or more lines of print, for checking the front of an appliance for controls, and for searching a telephone book for a particular name. It requires the student to maintain consistent fixation by holding the eye as steady as possible and moving the target in the appropriate direction, or holding the eye and the target steady and moving the head. Students with restricted fields and no central scotomas who are not using optical aids may prefer to scan with eye movements only. The following procedures may be used:

> The instructor notes the pattern in which the student reads the numbers, letters, or symbols. Is it left to right or top to bottom? Did the student skip any letters or lines or mis-call letters or confuse similar-looking letters? How did the student find the next line? Did he or she scan back to the left side of the page on the line just read, on the line below, or on a slant between the two lines?

If the foregoing task could not be performed, the instructor should place several rows of small objects on a table and ask the student to scan them, naming all the objects. The instructor should observe the position of the student's body, head, and eyes when performing these tasks. Optimal illumination and contrast should be provided.

Tracking

Tracking is required for following the movement of a pen across a page when writing or following the movement of a needle when sewing. Many shop and craft activities require good tracking skills as well. To check the student's tracking, the instructor should do as follows:

1. Move a small recognizable target from left to right, top to bottom, and in circular motions in front of the student and note his or her ability to follow the target by using head and eye movements, then only eye movements.
2. Gradually decrease target size and note the student's response.
3. Have the student move the target. Note the student's eye-hand coordination. Is the student able to maintain fixation on the target

as it moves? Does the student use head and eye movements or just eye movements? Tell the student to use head movements only and keep the eye steady if optical aids are to be tried.

Efficient Use of Visual Skills with Aids

This section discusses training students to use visual skills with aids and the techniques to be used with students who have difficulties with specific skills. The skills covered in this section are (a) focal distance, (b) localization, (c) scanning, (d) fixation, and (e) tracking.

Focal Distance

Patch the eye not being used if the student is monocular. The student should be advised that patching will not cause the eye to atrophy--a common concern of most students with this condition.

1. Instruct the student to view through the center of the lens.
2. Position the target (symbol or word on an index card) at the appropriate distance until the student recognizes it. Remember to have high contrast to distinguish between the figure and the ground.
3. Demonstrate the depth of focus by moving the card too close or too far away so the student notices the differences in depth.
4. Have the student hold the card at the appropriate focal distance for a clear image and then blur the image.
5. Measure the working distance and compare it with the focal distance. It should be noted that the working distance may be different from the focal distance because of the student's refractive error, accommodation, or blur interpretation. Make certain the card (and all reading materials) is (are) held on the same plane and at the approximate height as the lens used for reading.

If the student has problems with focal distance, the following techniques may be helpful:

1. Use a reading stand.
2. With a microscope or telemicroscope, attach a pipe cleaner to the temple of the frame so it protrudes the appropriate distance; the pipe cleaner must touch the page.
3. With a microscope or telemicroscope, cut a piece of stiff cardboard to the appropriate length; position one edge at the page and the other edge resting on the frame of the glasses.
4. For difficulty with the focal distance of a hand-held magnifier, use a stand magnifier of the same power (the clinician may need to add a plus-lens to

the spectacle for accommodation).

5. Touch the page to the student's nose or to the end of the lens and move it away slowly until the print is clear.

Localization

Have the student hold the target or place the target on a reading stand with his or her finger on the target. Preferred illumination is essential. Have the student find the target through the lens and position it at the correct focal distance.

If the student has problems with localization, these technique will be beneficial:

1. Use a typoscope or cutout to make localization easier. Position the cutout around the target and instruct the student to find the "window". Increase the contrast between the target and the background.
2. Have the student position the target in the area of clearest vision without the aid and then move the lens into position in front of the eye and focus on the target.
3. Have the student follow his or her arm down to the hand and the finger, or locate the finger and then shift to the target.
4. Have the student use a systematic searching pattern to locate the target (i.e., from top-left to right, back to left and down, and so on).
5. With a bioptic telemicroscope, have the student sight the target through the carrier lens, position the barrel of the telescope directly above the target, and move the eye up into the telescope. While viewing through the telescope, the student should slowly lower the head until the target is sighted. Apparent displacement occurs because of the upper mount of the bioptic. Explain this displacement and instruct the student to lower his or her head more than seems necessary.
6. With a paper clip, attach a red filter sheet on top of the page above the line to be read and a green filter sheet on the lower portion of the page below the line to be read. Instruct the student to find the line that is neither red nor green. The color that the student reports the page to be will indicate where he or she is looking.
7. For reading, have the student place a finger at the place where reading should begin by viewing the place without the aid (i.e., the headline or the top-left corner of the page), then move the lens into position, focus on the finger, and shift to print.
8. For reading, have the student get the page of print into focus with the lens, scan left to the margin, and then follow the line edges up to the top of the page.
9. If the problems persist, consult with the examiner about having the student change to an aid with a lower power or one that will give the student a

large field of view. If the student learns to localize with a lower-power aid, the student may be able to localize through the aid that was prescribed initially.

Scanning

Instruct the student to use a systematic scanning pattern to find the target or the inner detail on the target. For reading, tell the student to read slowly from left to right, to scan back to the first word of that line, and then shift to the line below.

Techniques to overcome difficulties with scanning are as follows:

1. Instruct the student to use a typoscope or a marker under the line.
2. Tell the student to position his or her finger at the beginning of the line, scan back to the finger, and then move the eye and finger down together.
3. If reading is the goal and scanning is difficult, a scanning exercise may be practiced. Use the dark lines and large numbers in a pattern such as the one below:

   1 ---2

   3 ---4

   5---6

   7 ---8

   9---10

The student is instructed to look from I to 2, back to 1, down to 3, and so forth. Words rather than numbers may be used at the next level. Then intersperse the words and numbers on the lines.

Fixation with an Aid

The student must regain fixation each time the eye is shifted in scanning. Regaining fixation is especially necessary to achieve consistency in recognizing print. If fixation is difficult, targets or details of targets will be skipped over while scanning.

If the student has problems with maintaining fixation with an aid, the instructor should try these techniques:

1. Increase the size of the target.
2. Consult with the clinician to experiment with increased or decreased magnification.
3. For students who must view eccentrically, isolate the target with a cutout or use a pointer. Move the pointer or cutout in the scanning direction that the student must cultivate. The student learns fixation for scanning by tracking a pointer or cutout and noting the details or the targets seen.
4. Use short, simple words and large print for reading.
5. Hand print or type exercises that are simple enough to master.
6. Increase contrast.
7. Increase the size of the target or the spacing between details.

Tips to Ensure Success

Observe the student's particular strengths and weaknesses during training as well as the expressions of the student's satisfaction and dissatisfaction. Note the student's understanding of how to use the low vision aid. It is helpful to have the student verbalize what the aid is used for, how she or he will practice with it at home, and so forth. Clear up any misconceptions before the student leaves the training session.

While using optical aids, some students experience headaches, eyestrain, dizziness, nausea, and tension in the back and neck muscles. Explain the commonality of these symptoms and do the following: (If the symptoms persist, consult the clinician.)

1. Instruct the student not to look around the room or in the distance with near aids. The student must be seated and view only the target.
2. Decrease the length of each training session and increase the number of sessions.
3. Tell the student to relax the facial, neck, back, and arm muscles and to breathe deeply.
4. Patch the eye not being used (unless the student is binocular) to prevent facial muscles from tightening or the unused eye from squinting or shutting.
5. Choose a time for the training session when the student is calm and alert.
6. Make sure the student looks through the center of the lens and not at the distortion at the edges. It may be helpful to patch the periphery of the lens.

Performing Specific Tasks

Virtually any task performed at arm's length or closer can be accomplished visually with the use of low vision aids. In this section, the tasks that students most often cite as desirable objectives will be used as examples in the presentation of techniques for training and the suggestions for materials.

Reading, which is necessary for communication and maintaining independence, is the task that most students state they would like to begin, improve, or return to. Writing, household tasks such as sewing, recreational tasks such as card-playing or playing a musical instrument, and vocational tasks such as operating machinery also allow students to function in the mainstream.

Some students with good visual skills may need only a short lesson with a specific aid. Such students practice the specific material they want to see and are ready immediately to integrate the aid into their lifestyles. Other students may need to build the necessary visual skills slowly, combine their visual skills with the motor skills required to operate the low vision aid, and then intertwine these skills to perform the specific task. For these students, each component of the task must be taught separately; after one component is learned, the student moves on to the next, more complicated component until all the components are mastered.

Reading

Optical Aids Used:

A hand-held magnifier, a stand magnifier, microscopes (full field, bifocal, trifocal, and half eye), telemicroscopes (full field, bioptic, and surgical).

Nonoptical Aids Used:

A typoscope or marker, a reading stand, colored filter sheets, large print, and illumination controls.

Training Tips

Always gear training for success. Never allow a student to continue struggling with print he or she cannot recognize consistently. Replace that print with a sample of material in a larger size print or with more spacing and contrast until the student achieves greater perception. A suggested sequence for training materials is this:

1. 20-24-point print (5M) newspaper headlines, large Sloan reading cards, hand-printed materials, and the first paragraph of a Feinbloom reading card.
2. 14-18-point (2-3M) large print materials (such as the large type *Reader's Digest*, *New York Times Weekly*), large type texts or library books, and material typed on a large print typewriter.
3. 8-10-point (I-1.5M) clear typed print with good contrast. For some students, spacing and contrast are more important than the size of the print. To maintain clarity, use a new typewriter ribbon.
4. 8-9-point (I M) regular book print in good clear print on opaque, off-white

paper (not paperback books).

5. 7-8-point (I M) magazine print similar to newspaper print but with better contrast; if the glossy paper creates glare, use a filter sheet.
6. 7-8-point (.08M) newspaper print, paperback book print, and other materials printed on poor-quality paper and on which the ink is blurred making reading difficult. Teach the student to localize the headline without an aid and then add an optical aid. Also, teach the student to notice the spacing between columns so the student does not read all the way across the page.
7. 4-5-point (.05M) very small print (found in want ads, stock market quotations, dictionaries, small Bibles, and telephone books). Use a marker or typoscope under the line of type in a telephone book or dictionary. Teach localization of the name or word by using the key name or word at the top of the page. Show the student how to skim occasional words in alphabetical order to find the desired word or name.

Success also may depend on how difficult the print is and the style of the type. The easiest material will have good spacing between lines and good density. Look for several different type styles: serif, sans serif, capitals and lower case, all capitals, bold face, italic face, and regular face. Practice material should be of several column widths.

Reading material should be appropriate to the comprehension level of the student. At first, use material with an easy vocabulary of short words. Gradually increase the complexity of the material until it is commensurate with the student's level of understanding, whether fourth grade or postdoctoral. A suggested sequence is as follows:

1. Recognition of letters.
2. Recognition of short words (two to three letters).
3. Introduction of longer words. If longer words are not recognizable, ask the student to spell or sound out the words phonetically.
4. Reading of sentences.
5. Reading short paragraphs (e.g., anecdotes, jokes, quotations, and sayings).
6. Reading short stories.

If the student continues to have problems with reading comprehension, the instructor may refer the student to a reading specialist.

Reading Forms, Bills, Statements, Computer Printouts, etc.

1. Instruct the student to scan the face of the form to become familiar with how the form is organized into columns.
2. Show the student how to find headings for the columns.
3. With two markers or typoscopes, teach the student to place the edges, down and across appropriate columns to find the desired entry.

Future Needs

Although numerous researchers have shown us the importance of teaching reading skills to people with low vision and Watson and Berg (1983) have given us an excellent curriculum for doing so, there is still much we do not know. Specific techniques and sequences lack empirical evidence of their effectiveness over other known or unknown techniques. Research in this area would help identify the best practices to follow.

As the number of persons surviving traumatic brain injury increases, there is a growing number of people who have both a visual impairment and cognitive and/or perceptual deficits. There is little in the literature on teaching reading to this population, and there are few training materials readily available. It is probable that the need for this information will increase in the near future.

Finally, Wright and Watson's *LUV Reading Series* is a wonderful resource for the low vision practitioner who has often had to guess at what were and were not appropriate reading materials. It would be nice to see companion volumes in languages other than English and also volumes that might reflect more narrow and specific cultural or regional backgrounds.

Annotated Bibliography on Reading Training for Persons with Low Vision

Backman, O., & Inde, K. (1979). ***Low vision training*****. Malmo, Sweden: LiberHermods. (English version is out of print. May be available through inter-library loan).**

This is a complete manual of instruction in low vision reading. It is written in a friendly, easy-to-understand style and contains many illustrations and photographs to improve understanding. Containing over 50 pages of training exercises, this book is self-instructive for the client and is set in large type and is double-spaced. It includes information on the eye, optical devices, and visual impairments. Readers in the U.S. may need to "translate" some of the European references and terms but these are minor.

Faye, E. E. (1984). Teaching the patient to use aids: The preliminary to the prescription. In E. E. Faye (Ed.), ***Clinical low vision*** **(2nd ed.). Boston: Little Brown.**

The author acknowledges that "Successful low vision care is more than a prescription for a low vision aid. A successful prescription is preceded by an instruction period..." However, only limited attention is paid to the specifics of near vision training. Although this chapter is filled with useful information, as a training manual, it is far from complete. Faye briefly discusses each type of near vision device and some training considerations for each but does not offer the depth of information on these topics provided by other authors. Interestingly, previous works on low vision training, which were available at the time this text was written, are not cited in the references. Readers will find this chapter a useful supplement but not a primary source.

Flax, M., Golembiewski, D., & McCaulley, B. (1993). ***Coping with low vision*****. San Diego, CA: Singular Publishing Group.**

The self-help manual and resource guide is designed for the older client with low vision and his or her family to help them better understand low vision and what can be done about it. It is written in easy-to-understand language that is free of jargon and is printed in 14-point type. Although it does not contain step-by-step instructions on reading with low vision, it provides a great deal of general information on low vision that can help clients better understand what is happening to them and how to cope more effectively.

Freeman, P. B., & Jose, R. T. (1991). ***The art and practice of low vision*****. Boston: Butterworth-Heinemann.**

This manual is designed to help the eye care provider (optometrist or ophthalmologist) who wishes to include low vision rehabilitation services in his or her practice. Although there is little specific information on instructing the patient with low vision in how to read, there is a series of "Low-Vision Homework Instructional Materials". These can be useful in helping the patient gain or improve use of his or her eccentric vision and to develop increased skill with a prescribed low vision device.

Ighe, S., & Phil, M. (1994). Reading training - four cases. In A. C. Kooijman et al. (Eds.), *Low vision: Research and new developments in rehabilitation* (pp. 255-258). Amsterdam, Holland: IOS Press.

This article presents the results of a small study of a reading training program. All subjects increased their reading speed by at least 100%. The basic elements of the training are outlined and this offers a general guideline for other practitioners who are designing their own programs.

Nowakowski, R. W. (1994). *Primary low vision care.* Norwalk, CT: Appleton and Lange.

Although little is said about specific instructional techniques in the use of optical devices for reading, chapter 22 (*Training in the Use of Low Vision Devices and Residual Vision*) offers "Sample Information Sheets" on the various types of low vision devices. These provide an outline of the basic instructions that might be given to a patient when he or she is sent home from a low vision evaluation with a "loaner" device. This type of information is important for patients to understand as they begin to learn to use their low vision device.

Spitzberg, L., Goodrich, G., & Perez-Franco, A. (1994). Reading and vertical magnification with retinitis pigmentosa. In A. C. Kooijman et al. (Eds.), *Low vision: research and new developments in rehabilitation* (pp. 275-278). Amsterdam, Holland: IOS Press.

The authors look at the use of cylindrical magnification (i.e., cylindrical mirror magnifier, bar magnifier) for reading by persons with constricted visual fields and find that this type of magnification improves the reading speed of those tested.

Watson, G. R., & Berg, R. V. (1983). Near training techniques. In R. T. Jose (Ed.), *Understanding low vision.* New York: American Foundation for the Blind.

This is one of the most complete chapters on low vision training available. Sections include: "Suggested Training Sequence", "Preparations for Training", "Presentations of Low Vision Aids", "Efficient Use of Visual Skills Without Aids and With Aids", a table of common problems and possible solutions, instructions for training in specific tasks, and Home Practice including suggested instruction sheets to be sent home with the client. The writing is clear and easy to understand so that those with only a basic knowledge of visual impairment should be able to follow easily. The list of suppliers of training equipment is dated and many of the listed providers have moved.

Wheatley, G. P. (1990). Instructing the patient with low vision to use a microscope for reading and near tasks. ***Journal of Vision Rehabilitation*****, *4*(2), 19-27.**

A short article filled with useful tips for the low vision practitioner who is already familiar with the basics of training in the use of microscopic devices. The author includes a handy "crib sheet" for converting working distances to/from standard and metric units.

Wright, V., & Watson, G. R. (1995). ***Learn to use your vision for reading, LUV Reading Series.*** **Lilburn, GA: Bear Consultants. (Distributed by Autofold, Inc., P.O. Box 1063, Gardner, MA 01440-6063. Voice: (508) 632-0667, FAX: (508) 632-5094), Internet: 76226.1414@CompuServe.com)**

This is a "workbook designed to help adult and/or developed readers with recent or long-term macular loss to acquire skills that will help them continue to read for utility and pleasure". The exercises and activities in the book are designed for independent, at-home use and allow readers to monitor their own success. Now that the Quillman series is out of print, low vision practitioners must develop their own practice and training materials. This manual provides a series of exercises of increasing difficulty and is the only known program to merge what is known about reading skills with a program in vision rehabilitation for persons with macular loss.

References

Backman, O., & Inde, K. (1979). *Low vision training*. Malmo, Sweden: LiberHermods.

Goodrich, G. L., Mehr, E. B., Quillman, R. D., Shaw, H. K., & Wiley, J. K. (1977). Training and practice effects in performance with low vision aids: A preliminary study. *American Journal of Optometry and Physiological Optics, 54*(5), 312-318.

Goodrich, G. L., & Quillman, R. D. (1977). Training eccentric viewing. *Journal of Visual Impairment and Blindness*, 71, 377-381.

Nilsson, U. L. (1990). Visual rehabilitation with and without educational training in the use of optical aids and residual vision: A prospective study of patients with advanced age-related macular degeneration. *Clinical Vision Science, 6*(1), 3-10.

Nilsson, U. L., & Nilsson, S. E. G. (1994). Educational training in the use of aids and residual vision is essential in rehabilitation of patients with severe age-related macular degeneration. In A. C. Kooijman et al. (Eds.), *Low vision: Research and new developments in rehabilitation* (pp. 147-54). Amsterdam, Holland: IOS Press.

Watson, G. R., & Berg, R. V. (1983). Near training techniques. In R. T. Jose (Ed.), *Understanding low vision.* New York: American Foundation for the Blind.

Wright, V., & Watson, G. R. (1995). *Learn to use your vision for reading*, LUV Reading Series. Lilburn, GA: Bear Consultants.

Using Assistive Technology in Literacy Education for Learners who are Blind or Visually Impaired

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Overview

The concept of "literacy" has evolved in recent years. It seems obvious that the ability to read and write continue to be important for all people striving for productive, useful lives. However, "literacy in the '90s' and beyond must also encompass the ever-changing "age of information" in which technology provides immediate access to a wealth of information previously difficult to obtain. The concept of literacy now includes "the ability to communicate meaning through language at various levels of proficiency--from rudimentary to the highly sophisticated--in a range of educational, social, and cultural contexts" (Rex, Koenig, Wornsley, & Baker, 1994). From a national perspective, general literacy has received unparalleled attention and support in recent years. The American public recognizes the importance of a literate society and government is involved at all levels in supporting and encouraging innovative projects which encourage and enhance literacy.

Literacy as a national goal is best served when viewed as a developmental process. Former President George Bush emphasized this concept in *America 2000: An Education Strategy* (Lewis, 1993, p. 3). Two of the six national education goals focus on this concept:

Goal 1: All children in America will start school ready to learn

Goal 5: Every adult American will be literate and will possess the knowledge and skills necessary to compete in a global economy and exercise the rights and responsibilities of citizenship...

Conventional definition supports literacy as a process which integrates many skills including the ability to read, write, speak, and listen. Professionals working with and teaching people of all ages have long endorsed these skills of literacy as foundational to future success. Integration of literacy skills as an integral component of life skills instruction must be maximized and encouraged for all learners.

Literacy and instruction of literacy skills is best viewed as a continuum. Instruction of literacy skills can be considered as a lifelong developmental process and best viewed as a process of growth and development. It does not simply "happen" when a pre-determined set of skills are mastered. Literacy involves many dimensions (e.g., cultural, social, traditional "knowledge-based", and technological literacy) yet, there is an increasingly less concise definition between literacy and illiteracy. Indeed, a person may well be literate in one domain and illiterate in another. Literacy skills develop over time and across domains, and can be viewed as being sequential across levels. The U.S. National Assessment of Educational Progress (NAEP) (Lewis, 1993) describe literacy on a continuum of five levels:

1. **Rudimentary**: Able to carry out simple reading tasks, such as following brief written directions or selecting the phrase to describe a picture.
2. **Basic**: Able to understand specific or sequentially presented information, such as locating facts in uncomplicated stories and news articles.

3. **Intermediate**: Able to see the relationships among ideas and to generalize, such as making generalizations about main ideas and the author's purpose.
4. **Adept**: Able to understand, summarize, and explain complicated information, such as analyzing unfamiliar material and providing reactions to whole texts.
5. **Advanced**: Able to synthesize and learn from specialized reading materials, such as extending and restructuring ideas in scientific articles or literary essays.

Literacy for all individuals, including those with vision impairments, is essential. Literacy can be demonstrated in four ways:

1. When an individual is successful in communicating through written communication;
2. Through communication with a desired audience;
3. Through the successful application of reading and writing skills; and
4. Occurring at different levels throughout the life span (Koenig, 1992).

The role that "technology instruction" can play relative to literacy becomes increasingly important when discussing the education of people who are blind or visually impaired. Technology is "The application of science, especially to industrial or commercial objectives" (*American Heritage Dictionary of the English Language*, 1995). This rather broad interpretation certainly means different things in different situations. In the day-to-day lives of most Americans, technology can include everything from using a microwave oven to going "on-line" and "surfing the Web" on a sophisticated home computer. The uses of technology and instruction in these uses can be broken into two primary categories: assistive technology that is "chip" driven (i.e., utilizes a computer chip for basic functioning) and "non-chip" driven. For the purpose of this paper, focus is placed on "chip" driven equipment.

Through the use of assistive technology, many people who are blind or visually impaired will be able to demonstrate literacy in the above mentioned ways. Assistive technology helps enable students who are blind or visually impaired to compete successfully in educational settings with sighted students who are also using educational technology. Access to information via technology allows workers who are blind or visually impaired to be productive employees in the "information age". Older citizens can remain more independent by using assistive technology in activities of daily living.

To achieve equity and a quality education, students who are blind or visually impaired must have comparable tools for writing and computational activities, and the means to access computerized instructional materials. This is in direct correlation with the *National Agenda for the Education of Children and Youths with Visual Impairments, Including Those with Multiple Disabilities.* (Corn, Hatlen, Huebner, Ryan, & Siller, 1995), Goal Statement 7: Access to developmental and educational services will include an assurance that instructional materials are available to students in the appropriate media and at the same time as their sighted peers. Accessibility for all ages must include immediate and equal access to appropriate tools for learning. With the appropriate selection, training, and use of technology for people who are blind or visually impaired, there is no reason for delays in access to information and materials.

People who are blind or visually impaired must have access to the full spectrum of reading materials. This access is often possible through alternative methods. Many people read Braille, some use audio tape, some prefer disk-based documentation, whereas others prefer large print. Through the use of assistive technology, each alternative can be made available to people who are blind or visually impaired. In many situations, assistive technology provides equal access to information for people who are blind or visually impaired. Assistive technology equipment and the training in the use of this equipment must be made available for students and for individuals concerned about competitive employment options. When carefully chosen and used, appropriate technology systems can be used to support, enhance, and promote Braille literacy (Mack, 1989). Through the use of technology, people who are blind or visually impaired will have an increased amount and variety of Braille reading materials, will have more immediate access to Braille reading and research materials, and will have expanded note-taking skills. Additionally, interfacing local Braille production systems with telecommunication technology provides immediate and on-going access to current information.

There often is not enough time in the school year for students to acquire the skills and/or information that might be relevant or useful to them in life. There is, however, time to teach students how to learn on their own (Anderson-Inman, 1993). The need to focus on generalized, independent learning skills is important for all students but particularly for students who are blind or visually impaired. Assistive technology plays an inordinately important role in providing skills in learning to access print materials that previously were difficult or impossible to obtain. Teaching and learning of technology skills must be broad based so individuals don't miss opportunities that could be pivotal to life long development (i.e., learning to create and access information via a personal computer with a synthesized speech system may prove more advantageous than learning a single use software package for a specific job). Instruction in technology can lead to an improvement in an individuals' quality of life, whether through improved performance in school or "on the job".

Need For Basic Technology Skills in School and Work Environments

For people with blindness or visual impairment, computer skill proficiency must be viewed as part of basic literacy. Such skills must often be learned and mastered before any vocational decisions are made (Luxton, 1990). Once an individual becomes literate in computing, learning can become a simpler process. People use technology to improve productivity, to solve problems, and to add to their existing knowledge base. Technology is a powerful tool which can be used to "piece together" new knowledge and provide solutions to problems. All students, sighted and visually impaired, must receive the instruction which provides them with skills in gathering and accessing information, and then subsequently in their ability to synthesize this information from various sources and disciplines to communicate this new knowledge and produce solutions to existing problems (Weld Co., 1994).

Common standards relative to instruction in technology skills must exist for **all** students, inclusive of students who are blind or visually impaired. In an effort to develop technological literacy and capability of all students, K-12, the Technology for All Americans Project (TAA) was developed. The goal of the project is to create standards for technology instruction for elementary and secondary schools. Technology education, as viewed by the TAA Project, has three overlapping roles. First, providing technological literacy for all students empowers them to apply their understandings to new situations and helps them determine when they need new knowledge. The second role is to provide a background for students to intelligently make choices in school-to-work transitions. The third is to provide pre-engineering education for those students interested in advanced education (Salinger, 1995). Through the work of the TAA Project, a set of *technology standards* is being developed which include:

1. Curriculum Content Standards for Technology
   a. Grades K-4
   b. Grades 5-8
   c. Grades 9-12
2. Student Assessment and Progress Standards
3. Standards for Professional Development and Preparation of Teacher Technology
4. Standards for School Programs and School System Teaching Technology

Many schools and agencies have created *benchmarks* which help define technology standards needed for instruction. Sample benchmarks may include:

- Students/clients will use various technology tools to research, create, and present a product in an appropriate manner;
- Students/clients will solve problems using appropriate tools of technology; and
- Students/clients will use technology to become self-directed learners.

Many schools and adult service providers are developing *minimum competencies* for instruction in technology for all students and clients. As an example, Weld County in Colorado offer the following benchmark competencies:

- All students will be able to keyboard at 20 words per minute before they leave a school.

- Elementary schools in the county must include at least 1 benchmark which includes the use of a word processing application program.
- Middle schools in the county must include at least 1 benchmark which demonstrates students' abilities to create a product using a multimedia authoring program.
- High schools must include 1 benchmark which demonstrates a students' ability to gather information using Internet.

Schools and agencies may develop "technology statements" that meet the needs of all students, such as:

- Technology skills providing expanded opportunities to succeed will be accessible to all students, regardless of language, special needs, or location.
- As technology is infused and integrated into each curricular discipline, learning can be made even more relevant and interactive.
- Technology empowers students to become life-long, self-directed learners by giving students a tool to construct, reflect upon, and test new information and knowledge.

Schools and agencies working with individuals who are blind or visually impaired need to work cooperatively to develop similar standards, benchmarks for definition of goals, minimum competencies, and statement goals specifying inclusion for all learners. Schools and agencies will provide themselves a foundation upon which they can develop comprehensive technology programs.

General technology tools and technology skills areas will apply to all students and clients. Learners who are blind or visually impaired may require adaptive hardware and software but the outcomes for the use of the tools should be the same. Tools of technology will fall into general categories:

General Technology Hardware

- Computers including desktop and laptop computers
- Printers
- Modems
- Electronic notetakers
- Scanners
- CD-ROM drives
- Fax Machines
- Speech Recognition Devices

Additional Hardware Needs for People who are Blind or Visually Impaired

- Adaptive Hardware:
  Refreshable Braille Displays
  Screen Enlargement Peripherals
  Speech Synthesizers
- Printers:
  Braille Embosser
- Electronic Note-takers:
  Voice Output Devices
  Braille Input/Output Devices
- Adaptive Software:
  Braille Translation Software
  Screen Readers
  Screen Enlargement Software
  Speech Recognition Software

General Technology Skill Areas

- Keyboarding Skills
- Research Skills
- Use and Control of Peripheral Devices
- Use and Control of Computer Operating Systems
- Word Processing
- Use of Database Management Software
- Use of Spreadsheet Software
- Use of Desktop Publishing Software
- Use of Scanners
- Use of E-mail
- Access and Use of On-Line Services/Internet

Additional Technology Skill Areas Specific for People who are Blind or Visually Impaired may include

Use of Adapted Output Systems:
- Enhanced Image Systems
- Synthesized Speech Systems
- Refreshable Braille Displays
- Use of Braille Printers
- Use of Adapted Input Systems
- Braille Input Devices
- Use of Voice Recognition Systems
- Use of Optical Character Recognition Systems

Use of Technology in Schools and Work Environments by Individuals who are Blind or Visually Impaired

Two primary computer operating systems are presently utilized by American schools and business communities: Windows/MS-DOS (used primarily on IBM and IBM compatible computers) and Macintosh OS (used on Apple Macintosh and Macintosh compatible computers). In both environments, two questions arise relative to system use by persons who are blind or visually impaired. First, how do users access the information presented on the screen? Second, how do users interact with the information once it is presented? Before discussing these two issues, it is necessary to present a "Glossary of Terms" relative to concepts involved in general computer use and access. The following terms are used throughout this paper.

Glossary of Terms

MS-DOS (Microsoft Disk Operating System): The software that controls all disk input/output, video functions, keyboard control, and internal commands. All computers need an operating system to function.

Macintosh OS (Macintosh Operating System) Version 6.X-7.5.X: The graphic-oriented system operating systems used on Apple Macintosh/Macintosh compatible computers.

Windows (includes Windows and Windows 95): The graphic-oriented operating system used on many IBM and IBM compatible computers.

Application: Software that is designed to carry out a certain type of action such as word processing or electronic mail.

Application Window: The main window of an application containing a menu bar and a workspace which can contain one or more document windows.

ASCII (American Standard Code for Information Interchange): Information written in standard ASCII format is considered "text-based", and does not include special formatting codes or graphics (see also: text file).

Button Bar: A horizontal bar just below the menu bar in some applications which is used to invoke frequently used functions.

CD-ROM (Compact Disk-Read Only Memory): A read only optical storage technology that uses compact disks as a means of data storage.

Chip: An integrated circuit created on a tiny silicon flake. A chip serves as the Central Processing Unit (CPU) for computers.

Click: Pressing the mouse button when the pointer is on an object to execute a function. Starting an application or closing a window are functions that require double clicking - pressing the mouse button twice quickly.

Command: An instruction given to a computer to carry out a particular action. A *Command Button* is often used as a graphical representation that is used to allow initiation of an action such as executing or canceling a command.

Control Menu: A menu invoked by clicking on a symbol located in the upper left corner of a window which is used to move, close, or resize that window.

Cursor: A symbol, usually a blinking horizontal or vertical bar, that designates the position on the screen where text or codes will or can be inserted or deleted.

Dialog Box: A pop-up window that prompts the user for additional information needed by Windows. For example, a dialog box appears to prompt the user to enter an alternative spelling when the spell checker finds a word that is not in its dictionary.

Document Window: A smaller window inside an application window that has no menu bar.

Drag and Drop: Holding the mouse button down while moving the pointer, with the primary function of moving text or an object (i.e., to highlight, move, or format a block of text).

Font: A group of letters, numbers, or symbols with a common typeface.

Icon: A small picture representing a file or application that usually has a text label below it. An icon is often similar visually to the object it represents. For example, a pen representing a word processing application. Clicking on the icon will usually execute an action.

List Box: A box that displays a list of choices. When a list is too long to display all choices, it will have a scroll bar so that you can view additional items.

Menu Bar: A one-line list of menu titles found just below the title bar at the top of an application window. The various menu options contain headings for pull-down menu items.

Mouse: An input device attached to a computer port which the user moves by hand to move the pointer or cursor and select commands.

Network: Two or more computers linked together for the purpose of sharing information and/or peripheral devices

OCR (Optical Character Recognition): The process by which information captured by a scanning system is converted into text.

Pointer: The arrow-shaped, on-screen representation of the mouse. In a text entry area, the pointer becomes an I-shaped symbol and is the insertion point for text.

Scroll Bar: A graphical symbol indicating that there is information that will not fit in the current window. The user clicks on graphical symbols on the scroll bar to "scroll" to the additional information.

Scan: The process of using a scanner to "read" or take a picture of printed material. Information entered into a computer from a scanner must be converted to text through an OCR software package.

Text Box: A one-line box that appears when Windows needs textual information from the user. For example, a box prompting the user to type in a word to initiate a word-search command.

Text File: A file saved in ASCII file format. It contains text, spaces, and returns, but no formatting codes.

Access to Computers for Individuals who are Blind or Visually Impaired

Current technology allows four primary methods for users who are blind or visually impaired to access and interact with computer information:

- Enhanced image display,
- Braille (input and output),
- Synthetic speech, and
- OCR (optical character recognition).

It should be noted that many users use a combination of these system adaptations. All four of these methods are available on both of the two primary operating systems used in schools and businesses today (MS-DOS and Windows; Macintosh). There are, however, many more options available in the former operating system, and in most circumstances, future trends for development of new products to enhance or allow increased access to computer environments for individuals who are blind or visually impaired are geared toward the MS-DOS/ Windows operating systems. Each of these four methods will be discussed, initially for the MS-DOS/Windows operation systems, followed by a discussion of access for the Macintosh operating system. Following each section are examples of current software/hardware peripherals common today. Full addresses for vendors are not listed here; rather, they are listed in the "Best Practices" section of this paper. Highlighted here are the issues involved in accessing a computer environment for each of the four mediums. Strategies for deciding which of these mediums to use is also included in the "Best Practices" section.

Enhanced Image

Enhanced image devices and software packages provide a process through which the image typically displayed on the computer monitor is enlarged. Some computer users requiring enlarged image find that the easiest adaptation is simply to use a larger monitor. Such a monitor will increase the size and amount of information displayed. For example, a 17" monitor allows for an approximate increase of on-screen text by about 50% when compared to a 12" monitor. Conversely, magnification software systems "change" the image displayed on the screen to varying degrees of magnification. Screen magnification software programs are loaded into a computer's memory and will magnify text and images supported on any size displaying monitor. The magnification can range anywhere from 2x to 16x. The size of the enlarged text and/or image depends on the current settings for enlargement and the size of the displaying monitor. Many of the screen enlargement software systems operate much like a magnifying glass moving over the monitor. Computer users can control the magnification to automatically follow the cursor or to move across and down a magnified image on the screen at a defined speed. Some of the screen magnification programs can display both the enlarged portion of the screen as well as the "typical" screen. The magnified portion can be controlled relative to contrast, color, and size. Most of the more "sophisticated" programs also allow for "smooth-edging" of fonts and graphics which circumvents some of the problems of "jagged" displays. Costs for screen magnification software packages currently range from about $80.00 to $600.00 dependent upon the capabilities of the software. Screen magnification software provides computer users with varying amounts of control over portions of the window to be enlarged, the size of magnification, color display, cursor and I-beam size, tracking speed, font size, and special viewing features.

For computer users who require minimal adaptation of display magnification, the system software, or in some cases the applications themselves, can be configured to display larger fonts. For example, users of Windows 3.1 can configure the fonts used in Windows applications and the icon names/titles to be enlarged. Users cannot, however, increase the size of icons or dialog box text without the use of a software magnification package. Users operating Windows 95 have much more control over magnification of font styles and size and icon display and dialog box text.

Computer users requiring enlarged access "input" devices can use a keyboard with attached large print keyboard labels ($10.00-$20.00), or they can use a separate enlarged Alpha and Numeric Keyboard (approximately $130.00).

Computer users requiring an enlarged image display with the Macintosh OS presently have two options. "CloseView", a free utility program included with Macintosh's system software, permits the screen display to be changed from black on white to white on black, and magnifies the screen from 2x to 16x. "inLARGE" is a software package that allows magnification of everything displayed on the screen from 2x-16x. As the user types or uses the mouse, the enlarged view follows the cursor.

Examples of enlarged image displays products include the following:

- ZoomText for DOS, ZoomText for Windows, ZoomText Plus (DOS and Windows): AI Squared
- Magnum Deluxe: Artic Technologies
- MAGic and MAGic Deluxe: Microsystems Software, Inc.
- inLARGE: Berkeley Access, Inc.

Braille Input/Output

Braille input devices with accompanying or additional software allow for access to the computer via a Braille keyboard, or by using the typical keyboard which has been assigned a Braille keypad equivalent through system extensions. Through such a system, the standard keyboard is converted into a Braille keyboard with specified keys on the keyboard used to "Braille" text and commands. It should be noted that accompanying software is necessary for use of all Braille input devices. Many of the Braille translation software packages include options for Braille input. Many of the Braille input devices primarily serve as stand-alone note-taking devices but have capabilities of interfacing with desktop and laptop computers.

Examples of Braille input devices (including Braille note-taking devices) include the following products:

- Braille 'n Speak and Braille Lite: Blazie Engineering
- BrailleMate2 and BrailleMate 2+2: TeleSensory
- David: Enabling Technologies
- Mountbatten Brailler: HumanWare, Inc.

Braille output devices allow for access to screen information via "Refreshable Braille", also known as "paperless Braille", and "hard-copy Braille" via Braille printers. Refreshable Braille displays function by raising and lowering different combinations of metal or plastic pins which correlate with the Braille dots. It is refreshable in that the Braille display changes as the text changes, advancing letter by letter or line by line. These displays can show up to 80 characters depending on the device. Usually, the display is positioned on the user's desk or underneath the computer keyboard. The refreshable Braille display can be separate components of a computer system or used concurrently with the standard keyboard. Current refreshable Braille displays cost from $3500.00 to over $15,000.00, with costs directly related to the number of characters capable of being displayed. Refreshable Braille displays offer some distinct advantages over speech output devices in that users can relate directly with specific formats of the displayed text. Tasks such as proof-reading for spelling errors, correct use of capitalization, formatting issues, and correct use of spaces is more easily accomplished with a Braille display of information than with a speech output system. A primary disadvantage of the refreshable Braille displays continues to be cost.

Examples of refreshable Braille displays include the following products:

- ALVA Braille Terminal: HumanWare, Inc.
- Braillex 2D: Adaptec
- DM80 and DM80/FM: TeleSensory
- INKA: TeleSensory
- KTX Braillotherm: American Thermoform Corporation

Braille printers/embossers provide hard-copy Braille pages of printed material and are a direct counterpart of typical ink-print devices. If grade II Braille is the desired output, users must first translate the text using a Braille translation software program. Costs for Braille embossers range from about $1,500.00 to over $80,000.00 dependent upon the volume of Braille production required.

Examples of Braille printer/embossers include the following products:

- Braille Blazer: Blazie Engineering
- Braille Bookmaker: Enabling Technologies Co.
- Braillo: American Thermoform Corporation
- Juliet, Thomas, and Marathon Brailler(s): Enabling Technologies
- Mountbatten Brailler: HumanWare, Inc.
- Porta-Thiel: TeleSensory
- Resus Braille Printer: American Thermoform Corporation
- Thiel BAX-10 Interpoint Braille Printer: TeleSensory

- Thomas Brailler: Enabling Technologies Co.
- VersaPoint Braille Embosser: TeleSensory

Examples of Braille translation software include the following products:

- Braille Talk PC: GW Micro
- Duxbury Braille Translator: Duxbury Systems, Inc. (available also on the Macintosh environment)
- MegaDots: Raised Dot Computing
- PC Braille Pro: ARTS Computer Products, Inc.
- EZBraille: High Expectations
- NFBTRANS: National Federation of the Blind
- TurboBraille: Kansys, Inc.

Synthetic Speech Systems

Synthetic Speech Systems are composed of two components: a speech synthesizer and a screen access program/screen reader. The speech synthesizer can either be a card that is inserted into the computer or an external device that is connected via cable to the computer. Speech synthesizers range in price from about $200.00 to $1,400.00. Typically, speech quality increases with an increase in price. The screen reader software is loaded into the computer with the primary function of "voicing" information which is available visually on the monitor. The computer user enters different key stroke commands either from the keyboard, from the keyboard numeric keypad, or from a peripheral keypad. Different commands send information to the speech synthesizer to be electronically "voiced". Dependent upon the specific screen reader software, users can give commands to read current characters, lines, and paragraphs, spell words, find specific strings of text, access "tools" such as spell checkers, or read specific cells in spreadsheet applications. Prices for screen reader software currently range from approximately $200.00 to $700.00.

Computer users requiring synthetic speech with the Macintosh OS primarily have one option at present. Berkeley Systems, Inc. manufacture a program called "OutSpoken" (approximately $495.00) which provides voice output for information displayed on the monitor. Different commands, usually controlled from the numeric keypad, provide the computer user with control of "voiced" windows, dialog boxes, and text.

As computer access via synthetic speech systems is often the option of choice for computer users who are blind or visually impaired, it is beneficial to also discuss basic computer operating systems and some inherent difficulties of accessing the computer via "voice"; it is also useful to understand the basic premises of computer access and interaction via the computer's operating system.

As discussed earlier, there are two primary computer operating systems presently utilized by schools and business communities: MS-DOS/Windows (used primarily on IBM and IBM compatible computers) and Macintosh OS (used on Apple Macintosh and Macintosh compatible computers). Users who are blind or visually impaired can access the Macintosh computer environment through synthetic speech; there are, however, many more options available for use on IBM and IBM compatible computers using the MS-DOS/Windows operating systems.

In DOS, strings of text commands are entered for most computer operations. These text strings are linearly based, providing a user who is blind easy understanding to the information once voiced via a screen reader and a speech synthesizer. However, the operating systems in the Windows environments (including Windows 95) are primarily "visually" based. The "ease of operation" factor is founded heavily on the use of icons and graphics to allow users access to computer functions. Windows has become the operating system of choice for most people using IBM compatible computers. With Windows, the computer can support applications much more powerful and sophisticated than those supported in the DOS environment. Windows' ability for multi-tasking (i.e., running computer programs simultaneously), and its ability to exchange information between applications give it a distinct advantage relative to "power" when compared to DOS. This is particularly true of the newest Windows operating system, Windows 95. This newest operating system from Microsoft can run more applications at once and at a faster speed. However, unlike its predecessor Windows 3.1, Windows 95 completely supplants MS-DOS. A computer user using Windows 95 can no longer **directly** access MS-DOS. Users who employ MS DOS-based assistive technology (i.e., DOS-based screen readers), may find it more difficult to access the computer.

To access the computer efficiently using a Windows environment, the user must be able to:

- Determine which window is currently active,
- Know where the mouse/pointer is currently located,
- Determine the various choice options being presented (which sometimes necessitates scrolling through various information choices), and
- Choose the option desired.

The MS-DOS operating system provides this information in a linear record; access to current commands is simply a matter or "reading" the current line. Review of the last several commands entered is simply a matter of reading previous lines. In Windows systems, information is presented in windows, dialog boxes, scroll menus, and document windows. When using a screen reader and accessing the full screen, or when reading a single line of information presented in the monitor screen, the user can easily be met with a jumble of unrelated verbiage that gives no indication regarding what to do next. In most DOS applications, much of the relevant information can be accessed as long as users can focus and interact with information available at the cursor. In DOS, users can easily determine the current cursor position via simple keyboard commands. In Windows, the cursor position is stated as an X and Y coordinate. This information does not always translate into a familiar reference point on the screen. In Windows, dialog boxes are presented on the screen at various locations. Once the dialog box is located, users must choose from the presented options and click on "OK" or "CANCEL" to exit the dialog box and return to the primary application window. "The process of becoming oriented to Windows is analogous to a blind person being placed in an unfamiliar area and them being told that standard travel skills will be useless in exploring the area" (Leventhal, 1995). One of the primary difficulties when dealing with Windows-based synthetic speech systems is the lack of standardization in the marketplace. The lack of standardization for such things as exact positions of dialog boxes, minimum and maximum sizes for icon's, and size and position of scroll screens makes consistent screen access through speech readers difficult. In recent months, there has been some consideration given by Microsoft, the company manufacturing the Windows operating system, to strategies which would allow for easier access for people who are blind. "New APIs (Application Programming Interface) and "hooks" are being developed to allow Independent Software Vendors (ISVs) to develop third-party accessibility aids, especially those which allow blind individuals to use Windows by way of a screen reader. These include the ability to access both low-level graphics operations as well as higher level graphics information, methods to retrieve window focus change and system carat location information, and methods for screen readers to bypass system criteria dialog boxes and messages" (Leventhal, 1995). These strategies, should they be developed, would provide the manufacturers of screen reader systems the flexibility to produce software that would perform efficiently with all applications developed by Microsoft and other companies following their lead. This flexibility would provide access to Windows-based applications similar to the level of access now available on DOS-based applications.

Examples of synthetic speech systems include the following products:

Screen Readers:

- Screen Power for Windows: TeleSensory
- WinVision 2: Artic Technologies
- outSPOKEN: (for Macintosh): Berkeley Systems
- JAWS and JAWS for Windows: Henter-Joyce
- Slimware and Slimware Window Bridge: Syntha-Voice Computers
- ArticVision: Artic Technologies
- VocalEyes: GW Micro

Speech Synthesizer Cards (external and internal cards):

- DECTalk: Digital Equipment Corp.
- Accent Speech Synthesizer: Aicom Corp.
- SpeakEasy: Chip Orange
- Echo: Echo Speech Corp.

Optical Character Recognition Systems

OCR (Optical Character Recognition) technology provides a computer user with the ability to "scan" printed text and convert the scanned image into text-based information. Once the information is converted to a text-based file, it can be accessed in any of the methods discussed so far (i.e., enhanced image display, Braille, synthetic speech).

For computer users who are blind or visually impaired, access to printed material via OCR technology involves three components: scanning (taking a "picture" of the printed material); recognition (converting the picture to text); and reading (accessing the converted information in the preferred medium, either enhanced image, Braille, or synthetic speech). OCR systems can be set up as peripheral attachments in addition to software on existing computer systems, or as stand-alone systems. Current OCR systems offer good accuracy and formatting capabilities in both configurations and allow a user who is blind or visually impaired access to printed material previously non-accessible. Prices range from $2,000.00 - $3,000.00 for systems already having the computer, where as self-contained systems range from about $5,000.00. Prices rise as capabilities of the OCR system increase. Systems are available that recognize a wide variety of printed information including books, magazines, newspapers, catalogs, bank statements, and information presented in tables and columns. No present systems are available that allow for recognition of handwritten information.

Examples of OCR systems include the following products:

Stand-Alone Systems:

- OpenBook: Arkenstone
- Reading Edge: Xerox Imaging Systems
- OsCAR: TeleSensory
- Rainbow Reading Machine: Technologies for the Visually Impaired

Off-The-Shelf Software:

- OmniPage Pro and WordScan Plus: Caere Corp.

Assessing for Assistive Technology Use

Considering the purchase and use of assistive technology systems is an important yet difficult decision. There are few resources to which potential users and/or professionals can turn when making decisions relative to computer systems and necessary adaptations for potential users who are blind or visually impaired. Three categories of information will be important to consider:

1. General information regarding computer use,
2. Software selection, and
3. Exploration of the four primary adapted mediums available: Best Practices for Deciding on Appropriate Assistive Technology Systems for Users who are Blind or Visually Impaired.

General Information Regarding Computer Use

The following issues should be considered for appropriate assessment and planning for instruction in the use of technology:

- Consider the long range implications of the impairment (i.e., Will the product (process) be something which will prove successful long-term?).
- Look for simple solutions. People tend to abandon devices which are too difficult to learn or too difficult to use.
- Consider the learning and work styles of the person who will be using the device.
- Consider any significant physical characteristics that might affect the use of the technology system.
- Consider the sensory needs of the person using the technology system (i.e., auditory, lighting, tactile).
- Consider the possible modifications that may be necessary to maintain a comfortable seating position.
- Consider specific uses of the technology system.
- Specify the computer skills the student will need to learn or refine.
- Identify the specific environment(s) in which the student will be using the technology system.
- Consider the peripherals that may be necessary.
- Consider the specific software that will be necessary in each of the environments for which the technology system will be used.
- Determine the students' primary reading medium.

It also is important to look at several issues relative to the computer itself, aside from any adaptations. Questions to ask when choosing a computer system include:

- Is it easy to learn to use?
- Is software available for the computer? Is the software accessible by people

who are blind or visually impaired?

- How much and what kinds of software, if any, come with the computer?
- How much memory (RAM) and how large a hard drive is offered? Can memory be added?
- Does the computer represent the latest in technology features? Is it upgradable in the future?
- Is the computer portable?
- Is the computer compatible with other computers that the user or family members use, or with those systems used in the work environment?
- What features does the computer offer (i.e., color, sounds, speech synthesis, etc.)?
- What assistive devices are available for people who are blind or visually impaired with this particular computer system?
- What is the cost for the entire system, including monitor, keyboard, mouse, additional memory (if necessary), and necessary assistive peripherals (i.e., speech synthesizer, larger monitor, Braille display, etc.)?

Software Selection

A software program is a set of instructions written in a language computers can understand. Programs can be stored on disks or on other media such as CD-ROM. Included with the purchase of a software program, in addition to the application itself, is a set of printed materials called program documentation. The documentation provides information about the program and directions for its application. An important feature for people who are blind or visually impaired is the availability of Braille and/or auditory documentation.

Computer software has several different purposes. Two primary purposes include "Instructional" software and "Tools" software. Instructional software assists in instruction. Types of programs include:

- Tutorials: These applications are designed to present new information.
- Drill and practice: These programs provide opportunities for guided practice.
- Educational games: These programs are designed to make learning fun and are primarily aimed at the school-age population. There are, however, several educational game applications written for adult learners.
- Discovery programs: These applications provide an environment in which students learn by experimentation.
- Simulation applications: These programs allow learners to make decisions and see the consequences of those decisions.
- Problem-solving programs: These applications provide practice in thinking skills.

Tool software serves as the mechanism for accomplishing such tasks as writing, drawing, or managing information. Programs include word processing, desktop publishing, art and music composition programs, database management programs, spreadsheet applications, and on-line software programs.

Perhaps the best way to evaluate software is to actually "test-run" the program while using a computer. For people who are blind or visually impaired, this might be accomplished by accessing the software at existing computer technology centers which may include:

- State vocational agencies serving people who are blind or visually impaired often operate technology centers with hands-on access to software for work and personal use.
- State schools for the blind often offer technology information and training.
- The National Federation of the Blind operates the International Braille and Technology Center for the Blind.
- The American Foundation for the Blind operates the National Technology Center.

Additionally, the following may be used to access some specific software titles:

- Software vendors,
- Consumer and Consumer groups,
- Itinerant Teachers of the Visually Impaired,
- University Teacher Training Programs, and
- Library Services for the Blind and Physically Impaired.

Selecting appropriate software for learners who are blind or visually impaired is a complex decision involving many variables. Things to be considered include:

- For what type of learner was the program designed (i.e., age, ability, interest, etc.)?
- How does the program present information (i.e., text, graphic, animation, color, music, sound effects, speech, etc.)?
- What computer use demands are placed on the learner (i.e., inserting the disk, selecting from the menu, etc.)?
- What physical demands are placed on the learner (i.e., keyboard selection, other devices, etc.)?
- What academic demands are placed on the learner (i.e., reading levels required, spelling demands, etc.)?
- Is the program under user control if the user is blind or visually impaired?
- What speed demands are placed on the learner?

Software selections for learners who are blind or visually impaired must involve considerations for accessibility, compatibility, and generalized use.

Exploration of the four primary adapted mediums available: Best Practices: Deciding on Appropriate Assistive Technology Systems for Users who are Blind or Visually Impaired

Technology is a large and rapidly changing field. Technology in and of itself will not change general literacy for people who are blind or visually impaired. It may, however, serve as an avenue to improve access as well as a tool to assist in the development of literacy at school and at work. In a previous section of this paper, each of the four primary mediums through which people who are blind or visually impaired can access a computer was discussed. The suggestions and discussion presented here illustrate methods for integrating technology, not for teaching specific subject areas. Specific applications for use are discussed for common assistive technology systems in school environments and in the workplace. Also discussed are suggested criteria to be considered when contemplating purchase or use of a given assistive technology system.

Enhanced Image

The enhanced image systems available in the marketplace today offer full access to computer systems for the computer user with a visual impairment. Of the four mediums through which individuals who are blind or visually impaired access computers, the enhanced image systems probably are the most easily adapted for school, work, and home environments. Users can choose among enhanced image systems that allow for various degrees of magnification, altered views of the computer, increased contrast, display in negative view, and change in color display. Probably more than with any other type of computer access for users who are blind or visually impaired, personal preferences will be the biggest factor when deciding which system to purchase. Obviously, computer users with visual impairments who choose enhanced image systems are able to visually access enlarged printed material and prefer print access to Braille or speech access. Almost all vendors manufacturing enhanced image software will make available a "demonstration" version of their software to potential purchasers. Users can compare many of the packages prior to actual purchase.

It should be noted that some users have found success in using enhanced image systems in combination with Braille output systems and/or synthetic speech systems.

Examples of Enhanced Image Systems:

1. ZoomText for DOS, ZoomText for Windows, ZoomText Plus (DOS and Windows):
   P.O. Box 669
   Manchester Center, VT 05252
   Phone (802) 362-3612
   FAX (802) 362-1670

2. inLARGE (for Macintosh computers)
   Berkeley Systems
   2095 Rose St.
   Berkeley, CA 94709
   Phone (510) 540-5535
   FAX (510) 540-5115

3. Magnum Deluxe
   Artic Technologies
   55 Park St. #2
   Troy, MI 48083-2753
   Phone (810) 588-7370
   FAX (810) 588-2650

4. MAGic and MAGic Deluxe
   600 Worcester Rd. St. B2
   Framingham, MA 01701
   Phone (800) 828-2600

Braille/Synthesized Speech

The combination of Braille and speech is one of the most common assistive technology systems in use today by computer users who are blind or visually impaired. Many users prefer Braille as a primary input strategy, with speech as the primary output. A popular combination includes use of a portable Braille note-taking computer with speech output. This portable system allows the user the option of transferring the information later to a desktop computer with more memory, if necessary, and in printing the information on either an ink-print or Braille printer. The Braille personal note-taking computers are portable, battery-operated devices with a Braille keyboard and speech or refreshable Braille output designed for portability. Users who are blind or visually impaired can review what they have written by listening to text read aloud by an internal speech synthesizer. Notetakers also allow the user to edit their text. The notetaker can be connected directly to a printer or to a computer system that includes a printer.

A personal notetaker can be used in an educational setting, in the workplace, and in the home.

Examples of Braille note-taking systems include:

1. "David"
   Enabling Technologies
   3102 S.E. Jay St.
   Stuart, FL 34997
   Phone (800) 777-3687
   FAX (407) 220-2920

2. Braille 'n Speak & Braille Lite
   Blazie Engineering
   105 E. Jarrettsville Rd.
   Forest Hill, MD 21050
   Phone (410) 893-9333
   FAX (410) 836-5040

3. BrailleMate 2, BrailleMate 2+2
   TeleSensory Corp.
   P.O. Box 7455
   455 North Bernardo
   Mountain View, CA 94039
   Phone (800) 227-8418

4. Mountbatten Brailler
   HumanWare, Inc.
   6245 King Rd.
   Loomis, CA 95659
   Phone (916) 652-7253 or (800) 772-3393

As stated previously, screen reader software and speech synthesizers, when used as part of a desktop or laptop computer system, allow users to quickly read on command by word, line, sentence, paragraph, etc.; control the speed, volume and pitch of speech; and generally access the displayed output of their computer system. This system suits users who are blind or visually impaired requiring fast, constant, generalized access to computer information. It is difficult, however, to appropriately edit large bodies of information and to format easily or quickly using speech output systems. Additionally, speech output provides no access to graphics-oriented information. This issue becomes increasingly relevant as computer software is written specifically for use with Windows and Windows 95, the Microsoft graphics-oriented system software. Screen reader software include the following:

Graphics system operating systems access:

1. ScreenPower for Windows: Provides textual translations of all icons, buttons, scroll bars, and command elements in the Windows environment. It is compatible with 30 speech synthesizers and TeleSensory's line of refreshable Braille displays.
   TeleSensory
   455 North Bernardo Avenue
   P.O. Box 7455
   Mountain View, CA 94039-7455
   Phone (415) 960-0920
   FAX (415) 969-9064

2. WinVision 2 (upgrade to WinVision software): Features allow users to review an entire document; spreadsheet mode; highlight reading; and support for Adobe Type manager.
   Artic Technologies
   55 Park St. #2
   Troy, MI 48083-2753
   Phone (810) 588-7370
   FAX (810) 588-2650

3. outSPOKEN for Macintosh Computers: The numeric keypad is used to control the cursor. The structure and content of the display can be voiced.
   Berkeley Systems
   2095 Rose St.
   Berkeley, CA 94709
   Phone (510) 540-5535
   FAX (510) 540-5115

4. JAWS for Windows: Features a design that uses keys that do not conflict with those used in popular applications software. The program offers a complete menu systems to control every aspect of the program.
   Henter-Joyce, Inc.
   2100 62nd Ave. N.
   St. Petersburg, FL 33702
   FAX (813) 528-8901

5. Slimware Window Bridge for IBM and compatible computers: Features automatic tracking of pull-down menus, automatic reading of dialog boxes, user definable windows for software configuration, and macro capability.
   Syntha-Voice Computers
   125 Gailmont Dr.
   Hamilton, Ontario CANADA
   Phone (416) 578-0625
   FAX (416) 578-5183

Text-based system operating screen readers:

1. Artic Vision and Artic Business Vision for IBM and compatible computers:
   Artic Technologies
   55 Park St. #2
   Troy, MI 48083-2753
   Phone (810) 588-7370
   FAX (810) 588-2650

2. Speaqualizer. A peripheral hardware device for IBM and compatible computers; since the system is hardware-based, it does not utilize any of the computer's memory.
   American Printing House for the Blind
   P.O. Box 6085
   Department 0086
   Louisville, KY 40206-0085
   Phone (800) 223-1839
   FAX (502) 895-1509

3. JAWS for IBM and compatible computers: Dual cursor allows the user to read the screen and leave the PC cursor ready to interact with the application.
   Henter-Joyce, Inc.
   2100 62nd Ave. N.
   St. Petersburg, FL 33701
   Phone (813) 528-8900
   FAX (813) 528-8901

4. Slimware for IBM computers with at least 4 MB of available hard disk space:
   Syntha-Voice Computers
   125 Gailmont Dr.
   Hamilton, Ontario CANADA
   Phone (416) 578-0625
   FAX (416) 578-5183

5. VocalEyes for IBM and compatibles: Features full support for monitor attributes, dialog box readings, "hot-keys" for user-defined macros, and cursor control; works with a variety of speech synthesizers.
GW Micro
310 Raquet Dr.
Fort Wayne, IN 46825
Phone (219) 483-3625
FAX (219) 484-2510

Speech Synthesizers:

1. DECTalkDigital Equipment Corp.
Two Penn Plaza
New York, NY 10121
Phone (212) 856-3100

2. Accent Speech Synthesizer Aicom Corp.
1590 Oakland Rd.
San Jose, CA 95131
Phone (408) 453-8251

3. SpeakEasy
Chip Orange
3227 Rain Valley Ct.
Tallahassee, FL 32308
Phone (904) 487-2680

4. Echo-Echo Speech Corp.
6460 Via Real
Carpinteria, CA 93013
Phone (805) 684-4593

Computer users who are blind or visually impaired who require extensive monitoring of information or who require extensive and frequent editing of information often find success with a combination of speech output systems with refreshable Braille output display. Several features should be noted when considering Braille output, particularly refreshable Braille displays, including:

- Portability: Refreshable Braille displays are not very portable.
- Cost: As mentioned previously, refreshable Braille displays recently are very expensive.
- Amount of Braille to be displayed: Products display 20, 40, or 80 characters.
- Comfort with and ability to utilize a combination of Braille and speech output simultaneously.

Refreshable Braille, used in combination with speech output, may be the system of choice for users requiring more sophisticated access to the computer, particularly in work environments, in advanced college study, etc. Usually, cost prohibits widespread use of refreshable Braille in most school environments.

Refreshable Braille Displays:

ALVA Braille Terminal & KeyBraille
HumanWare, Inc.
6245 King Rd.
Lommis, CA 95650
Phone (916) 652-7253 or (800) 722-3393

Braillex 2D
Adaptec
J. Wood and Assoc.
P.O. Box 180
Fairfax Station, VA 22039
Phone (703) 715-6072

DM80 and DM80/FM
Accessibility Technologies
Baum, USA
17525 Ventura Blvd. #303
Encino, CA 91316
Phone (818) 981-2253 or (800) 225-3150

INKA
TeleSensory
455 North Bernardo Avenue
P.O. Box 7455
Mountain View, CA 94039-7455
Phone (415) 960-0920
FAX (415) 969-9064

KTX Braillotherm
American Thermoform Corporation
2311 Travers Ave.
City of Commerce, CA 90040
Phone (213) 723-9021 or (800) 331-3676

Optical Character Recognition (OCR)/Synthesized Speech Systems

As stated previously, OCR systems translate print into electronic information. A document is scanned, its print is analyzed by character recognition software, and the text is read aloud by the computer synthesized speech reading system. These systems are also known as "talking" OCR systems.

The use of these systems have applications in school and at work. Individuals with visual impairments whose learning style indicates a primary learning medium in the auditory areas could benefit from the use of an OCR system. People who are blind or visually impaired can access pleasure reading materials, textbooks, typed memos, faxes, work-related documents, and medical documents with an appropriate OCR system. Factors to be considered in addition to the reading medium include:

- volume of the material to be read,
- necessity for portability,
- variety of typewritten and typeset of documents to be read,
- amount of "graphics" included in typically read documents, and
- the need for a stand-alone OCR system as opposed to off-the-shelf OCR packages.

Stand-Alone Talking OCR Systems:

1. OpenBook. An OCR system that comes with a specially designed PC computer:
   Arkenstone, Inc.
   1390 Borregas Ave.
   Sunnyvale, CA 94089
   Phone (408) 752-2220
   FAX (408) 645-6739

2. Reading Edge
   Xerox Imaging Systems
   Personal Reader Department
   9 Centennial Dr.
   Peabody, MA 01960
   Phone (800) 421-7323

3. OsCAR. A PC-based OCR system:
   TeleSensory
   455 North Bernardo Avenue
   P.O. Box 7455
   Mountain View, CA 94039-7455
   Phone (415) 960-0920
   FAX (415) 969-9064

4. Rainbow Reading Machine. A stand-alone system:
Technologies for the Visually Impaired, Inc.
9 Nolan Ct.
Hauppauge, NY 11788
Phone (516) 724-4479

Off-The-Shelf OCR Software Packages:

These packaged software titles must be used in combination with a scanner and a computer system.

OmniPage Pro 6.0 and WordScan Plus
4.0 Caere Corp.
100 Cooper Ct.
Los Gatos, CA 95030
Phone (800) 535-7226

Access to CD-ROM Technology

CD-ROM (compact disk, read only memory) disks are physically the same as audio CDs. They are capable of storing massive amounts of data on a single disk. Any personal computer that is equipped with a CD-ROM drive, screen reader software, and a speech synthesizer can convert text information included on a CD into information usable by people who are blind or visually impaired. Through CD-ROM technology, computer users who are blind or visually impaired can gain access to many reference books. Unfortunately, CD-ROM software development is not standardized. Increasingly, CD-ROM disks are using multimedia to present information and much of the information is graphic. Multimedia disks include digitized images and sound that rely on visual cues and images. Even with that drawback, previously unavailable audio materials become accessible. Users accessing the computer via Windows-based screen reader software have more access to many modern CD-ROM disks, as many of these newer CD-ROM disks are written for the Windows environment.

Internet Access and Use

One of the fastest areas of change relative to computer technology, indeed to information exchange, is the use and almost unimaginable growth in the Internet. Daily, computer users and non-computer users alike hear of Internet resources, the wide spread use of E-mail, Web browsers, "cruising the Net", Use net access, Bulletin Board Services, "message postings", and on-line chat rooms. The Internet is rapidly changing the way people access and exchange information. Many people feel that "the Net" has the capability to change all aspects of day-to-day functions in schools, homes, and businesses.

So what is the Internet? Simply stated, the Internet is the world's largest computer network. Literally thousands of computers, connected directly or remotely via some system of cables, wires, or through "wireless" interface, allow computer users to access information which is available on any single computer system. This can mean access to information on corporate network systems (AT&T, Hewlett-Packard, etc.); access to library resource information in university computer systems; government computer systems; or access to "Mom's bread recipe" on a single-user home computer. The number of networked computer systems and computer users using the Internet is expanding so rapidly that exact figures are near impossible to ascertain. The Internet is growing exponentially. The Internet Society have forecasted that there will be approximately 124 million computers on the Internet by the year 2000 if the current growth rate continues. Other more conservative estimates place the figure around 70 million (S.W.V. Marketing and Media Strategists, 1996). What does use of Internet services offer computer users presently and in the future? Certainly the Internet is unlike any other form of communication humans have ever experienced. It is a medium through which all people, regardless of race, age, creed, nationality, or disability can communicate, exchange information, and share ideas, opinions, and data equally. It is a new communications technology that is affecting our lives on a scale as grand as television, radio, and the telephone.

Prior to discussing Internet access for computer users who are blind or visually impaired, it is helpful to discuss some of the features and functions all computer users can access through the Internet. These include but certainly are not limited to:

- E-mail: This service is probably the most widely used aspect of the Internet. Worldwide, people send messages electronically to others via the Internet. People use E-mail for everything for which they have typically used the telephone or the "paper" mail system. Additionally, E-mail systems allow users to join group discussions via electronic mailing lists which "link" together people with similar interests.
- The World Wide Web (also know as "the Web", or "WWW"): The WWW is an Internet resource that uses a multimedia approach to the presentation of information, combining sounds, text, graphics, even video and animation via *hypertext and hyperlinks,* which allow for "linking" of documents stored on different computers. A special computer language called HyperText Transfer Protocol (HTTP) is used by Web programs to create the hyperlinks; this language allows large corporations as well as home users to create and electronically "distribute" Web Pages, all of which are "linkable" to other Web Pages or Web Sites. The software which allows computer users to access the WWW is called a "browser".
- Bulletin Board Service (BBS): Bulletin Board Services allow for the "posting" and exchange of electronic messages on topics ranging from very technical information to hobbies such as stamp collecting and

skateboarding.

- File Search and Exchange: Files containing documents, pictures, video clips, and/or application programs can be sent and received via the Internet. Through resource manager and retrieval software, users can complete tasks including locating specific documents, researching specific subjects for eventual downloading (copying) onto home computers, and searching for digitized videos. Users can "log on" to constantly updated satellite weather information, locate current fare information on upcoming travel, search the Library of Congress for bibliographic information, or locate the most current version of a favorite arcade game.
- Live Conferencing: Internet users are able to "talk" live to other users. This communication can range from simple exchange of keyboard text information to live speech and video conferencing.
- Database management and exchange: In some professions, Internet management and exchange of data which is relevant to many users is becoming the system of choice. For example, medical researchers are using the Internet to maintain very large databases of rapidly changing data, making this information accessible to all who require such. Many schools and educational institutions are making complete lesson plans, curricula, and assessment information available to teachers and parents.

The use of Internet resources allow access to literally thousands of computer systems if desired. Once connected to the Internet system, the vast majority of services are offered free of charge. Internet Service Providers (ISPs), those companies and organizations that offer access into the Internet system, vary in cost, ranging from about $5.00/month. Many computer users can access the Internet through connections already established at their place of work, at their schools, or at local libraries.

One of the unique attributes of the Internet, as compared to other forms of information and communication exchange, is the equality granted to all participants. No single computer is inherently "better" than another, nor is any single computer user inherently "better" than another. Successful access to Internet services and information is solely dependent on individual skills. There is no bias. Who "are" on the Internet is dependent on how they present themselves via the keyboard. Ultimately, it does not matter how an individual user is accessing information gathered from Internet resources. Once information is located or exchanged, access to this information can be ascertained through traditional display on the computer monitor, through print on an ink printer, or via synthetic speech output, Braille output, or enhanced image display. This incredible fact provides computer users who are blind or visually impaired the opportunity, for the first time in history, to compete equally with sighted counterparts while exchanging and/or accessing information.

Internet Access for Computer Users who are Blind or Visually Impaired

Access to Internet resources using assistive technology is more an issue of accessing the software that accesses the Internet. For example, to access the World Wide Web, computer users must utilize a Web Browser. Two commercially available Web Browsers are Netscape and Mosaic. To access E-mail, users must run an E-mail software program. Some Web Browsers include E-mail access, but more often, separate E-mail software packages are used. Some examples include Eudora and Claris. To access some applications and data, users must access remote file servers (computers on which these applications/data are stored). Using File Transfer Protocol (FTP), users can retrieve the information from the source computer. Some Web Browsers allow FTP transfers, as do separate FTP "fetch" software such as Aldus Fetch. In addition to these various specialized software packages which allow various levels of access to the Internet, most commercial on-line services (e.g., America OnLine, Compuserve, and Prodigy) also allow various levels of access to the Internet.

For computer users who are blind or visually impaired who wish to access these various software packages via enhanced image display, these programs will not be any different than any other application program they are accessing with enhanced image software. Screen magnification will be determined by the user, and all text and graphics will be accessible at the enlarged capacity. Users can control the magnification to automatically follow the cursor, or to move across and down a magnified image on the screen at a defined speed. The magnified portion can be controlled relative to contrast, color, and size.

For computer users who are blind or visually impaired who wish to access the Internet access software via Braille and/or synthetic speech, the access process becomes more difficult. Several years ago, the vast majority of access software was text-based; information that was accessed on the Internet was provided as ASCII text. As mentioned previously, when information and programs are text- or ASCII-based, they typically are easily accessible by users utilizing either Braille output and/or synthesized speech. The difficulties with current software and with access application software being discussed for future use on the Internet lie with the graphics orientation. Sighted computer users welcome the change from text-based to graphics-based applications. They can easily use the icon representations and the mouse to "point, click, and choose". For computer users who are blind or visually impaired, this trend toward graphic applications is a difficult obstacle. The concepts that allow easy access for sighted users prove to be a major stumbling block for those accessing the software non-visually. Some of the typically graphic-oriented software, such as Netscape and Mosaic, can be configured to import and display the text information only. However, much of the information continues to be difficult to access due to graphics.

As Internet use increases, the software and programming languages used to create information that is "posted" on the Internet becomes increasingly complex. Avid Internet users presently are waiting for the new Internet programming language, Java, through which Web Pages can include animation, graphics, games, and other special effects. Java will allow sighted computer "Web Surfers" great flexibility in interacting with information and Web Pages via buttons, slides, text fields, and icons. Three dimensional figures will be able to be rotated using Java, offering fluid animations and enhanced graphics, sounds, and video. The implications of Java relative to non-visual access are yet to be seen.

There is one very promising solution for computer users who are blind or visually impaired wishing to access the Internet via Braille and/or synthetic speech. A group of programmers from the University of Kansas have developed a "character-cell" text-based Internet browser called "Lynx". According to the *Lynx Users Guide*, Version 2.3.7B, "Lynx is a fully-featured World Wide Web client for users running a cursor-addressable, character-cell display device...it will display hypertext markup language (HTML) documents containing links to files residing on the local system, as well as files residing on remote systems running Gopher, HTTP, and FTP servers" (Lavendar, Blythe, Montulli, & Grobe, 1997). Stated simply, Lynx offers computer users access to the World Wide Web through ASCII text. Such text is easily accessible via Braille and/or synthetic speech. One problem continues to be access to Web Pages designed by people who developed the pages with heavy reliance on graphics. If the designers of such Web Pages don't allow for access to information in any way other than icons and other graphics, non-visual access will be difficult.

Issues and Implications for Future Access to Information via Technology

Technology is rapidly changing the ability and ease through which people who are blind or visually impaired can access information. Many innovative projects, some currently operating as "proto-types" are clearly illustrating how assistive technology can provide increased opportunities. In addition to all current assistive technology systems (as discussed throughout this paper) being expanded and improved, seven areas regarding future use of technology appear to have great implications for learners who are blind or visually impaired.

- FAX technology: Using FAX, centralized reading services for people who are blind or visually impaired can be established. Print materials, including typed and handwritten information, could be faxed to a central location, where the material could be read by a sighted reader via the telephone. The central location would be similar to existing "relay" systems presently used by people who are deaf or hearing impaired who wish to communicate on the phone with another person who does not have a TTY. As an example, AllNet Communication Services donated a toll-free telephone service to Smith-Kettlewell Eye Research for such a project. (For more information, contact: Brogan and Partners, 2000 Fisher Building, Detroit, MC 48202).
- Handwriting Recognition: Systems that recognize handwriting, interfacing

with voice access are presently being developed. Commercial companies are working on the handwriting recognition systems. Such a system could be connected to an "at-home" computer system with synthetic speech or Braille output for users who are blind or visually impaired.

- Standardization in Graphic System Operating Systems: As stated previously, one of the primary "blocks" in access via speech and/or Braille lies in the graphic environment of popular system operating systems. Standardization of issues related to icon design, icon placement, window display and dialog box placement, etc. would allow independent software vendors to more easily develop third party accessibility aids which would allow computer users who are blind or visually impaired to more easily access the graphic environments, particularly Windows and Windows 95.
- Electronic Textbooks: An example of present (and future) electronic textbook systems is run with the TEXT2000 software program. This program operates on MS-DOS compatible computers and is designed to allow users to read textbooks stored on disk with adaptive devices for synthetic speech, refreshable Braille, or screen magnification. This project is sponsored by the American Printing House for the Blind. Making textbooks and other print materials available electronically, storing the data either on disk or on remote servers into which users "log-on", will provide access in any medium utilized by computer users who are blind or visually impaired.
- Universal and Standardized Information Exchange: A good example of information exchange can be found in the Universal Access Project. The project focuses on making the "information highway" more accessible. Sponsored by the University of Wisconsin's Trace Research and Development Center, the goals are (a) to gather information about barriers to new technology and to create dialogue among consumer groups, the disability communities, and the information industry; and (b) to set policy and standards for accessible service material, pipelines, and end user devices. Another example of universal information exchange can be found on the Internet user groups. BLIND-L provides a medium for exchange of information, specifically geared to computer use by individuals who are blind or visually impaired. (To subscribe, send a message to *listserv@uafsysb.vark.edu* and include in the body of the message "subscribe blind-l.) As more people utilize the Internet, this medium will become increasingly important to exchange ideas and information. The area of assistive technology changes rapidly, and if access for users who are blind or visually impaired is to continue, there needs to be an established and on-going system for information exchange.
- Speech Recognition Systems: The concept of utilizing human speech as a primary input system for computers has great implications for users who are blind or visually impaired. The biggest barriers presently are cost, speed of input, and accuracy of voice recognition. Several systems are currently available, and are being improved, including:

1. Dragon Dictate: A voice-activated system which can be used to control the computer by voice.

2. Kurzweil Voice: A voice-activated computer control system. MetaVoice is a module that provides speech output so users who are blind or visually impaired can access the system.

- Displaying and Interacting with Graphic Information: Further research is needed on techniques and strategies of conveying graphical information presented in modern software programs. As an example, 3-D technology, which is being developed to allow a person to localize sound presented through headphones, might also be used to access a display monitor non-visually to gain spatial orientation to the graphic information. As graphic information becomes more common-place in software applications, users who are blind or visually impaired are going to need increased access to this information.

Funding of Assistive Technology

One of the biggest areas of concerns relative to assistive technology for learners who are blind or visually impaired lies in the cost of many of the adapted systems. The simplest of synthetic speech systems can cost several hundred dollars; refreshable Braille can cost tens of thousands of dollars; these costs are in addition to the computer system. Obviously, an average person cannot afford these types of systems, even if they allow unparalleled access to information. Focus must continue on developing and expanding ideas to help fund assistive technology to meet future needs. Care must be taken to clearly identify the needs of the user, keeping long-range future use in mind.

For adult learners who are blind or visually impaired, the following resources can be explored for funding of assistive technology:

- Assistive Technology systems may be funded fully or partially by state vocational rehabilitation agencies as part of the Individualized Written Rehabilitation Plan (IWRP).
- Vocational rehabilitation services may provide and/or pay for training on the use of assistive technology systems.
- Community service organizations and clubs may assist in the purchase of some of the specialized equipment.
- Employers may purchase equipment for use on the job.

For school-age students who are blind or visually impaired, one must consider the implications of access to technology as part of the students' educational curriculum. Public Law 101-476, the Individuals with Disabilities Act (IDEA), is a mandated federal law on special education. IDEA provides the following definition related to technology: "An Assistive Technology Device is any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities" (Assistive Technology Device, 1996). Assistive Technology services is "any service that directly assists an individual with a disability in the selection, acquisition, or use of an assistive technology device" (Assistive Technology Service, 1996). Through the development of the Individualized Education Program (IEP), a student's need for assistive technology will be determined. If technology is judged by a Multidisciplinary Team serving the individual child to be a necessary part of a student's educational program, that technology MUST be provided at no cost to the parents. A clear, in-depth evaluation must be conducted to determine appropriate needed technology, and exact assistive technology needs must be clearly stated as part of the IEP process.

The following resources can be useful when exploring funding options for assistive technology for all learners who are blind or visually impaired:

"Resources the Disabled Can Use to Fund and Acquire Computers" in
Disability Bookshop Catalog
Twin Peaks Press
P.O. Box 129
Vancouver, WA 98666-0129

"Funding for Assistive Technology and Related Services"
Special Needs Project
2463 State St., Suite 282D
Santa Barbara, CA 93105
(800) 333-6867

Hazelhurst Foundation
512 North Larchmont Blvd.
Los Angeles, CA 90004
(213) 468-8832

This foundation will assist an individual who is blind or visually impaired to purchase a computer system by providing interest-free loans.

Computers for Classrooms: A network of cooperating agencies who disseminate used computers and technology systems to schools.
Contact one of the following agencies for information on donating or acquiring computer equipment:
Gifts in Kind America: (800) 862-GIFT
The East-West Education Development Foundation: (617) 542-1234
The National Cristina Foundation: (800) 274-8462

"Funding for Persons with Vision Impairments: PLUS Edition"
Reference Service Press
(415) 594-0743
ISBN #0-918276-51-9

This disk includes listing of scholarships, fellowships, loans, grant-in-aid, awards, and internships for persons who are blind or visually impaired. Available in both Macintosh and IBM compatible versions, the text is ASCII-based and can be read by any standard word processing program.

IBM Offering
(800) 426-4832

IBM and the Easter Seal Society have created this program to provide qualified people with disabilities computers and adaptive access devices at a discount.

- **Additional Technology Funding Source**

American Foundation for the Blind
Xerox/Kurzweil Personal Reader Purchase Assistance Program
11 Penn Plaza, Suite 300, New York, NY 10001
(212) 502-7600

California Council of the Blind
(818) 349-2636

Provides low-interest loans to those needing to purchase adaptive computer equipment.

Christian Fund for the Disabled
P.O. Box 3333, Agoura Hills, CA 91301
(818) 707-5664

Has a matching grant program with churches to help people buy medical and adaptive equipment.

- **Resources for BBS (Bulletin Board Services)**

4-Sights Network BBS
Upshaw Institute for the Blind
16625 Grand River Avenue, Detroit, MI 48227
(313) 272-3900 voice; (313) 272-7111 modem

Computer BBS for consumers who are blind and for professionals working in the field of blindness.

ACB On-Line (American Council of the Blind)
(202) 331-1058 modem

Alternative Inputs
44 Till Rock Lane, Norwell, MA 02061
617) 826-4365 voice; (617) 826-8960 modem

BlinkLink
Pittsburgh, PA
(412) 766-0732 modem

Colorado School for the Deaf and Blind
(719) 632-8180 modem

This BBS has a separate section for registered transcribers and "chat rooms".

Cyberia
Cyberia Communications
Box 172, 2536 Eastern Blvd., York, PA 17402
(717) 840-1444 modem

This is a BBS used by many, but is easy to access with speech software.

FEDIX Clearinghouse BBS
555 Quince Orchard Road, Suite 200, Gaithersburg, MD 20878
Modem Line: (800) 783-3349
Help Line: (301) 975-0103

This BBS lists federal educational materials.

Handicapped Education Exchange (HEX)
Baltimore, MD
(301) 593-7357 modem; (301) 593-7033 TTY

LINCS - BBS
PHP, Family Resource Center for Children with Special Needs
535 Race Street, Suite 140, San Jose, CA 95126
(408) 288-5010 voice; (408) 288-7943 FAX; (408) 294-6933 modem

This free BBS is for parents of children with special needs and professionals who work with them.

NFB Net (National Federation of the Blind)
(410) 752-5011 modem

The Braillery
No. 5, Cumberland Circle, El Paso, TX 79903
(915) 565-0601 BBS; (915) 565-0179 voice

This is set up specifically for persons who are visually impaired who utilize speech or large print for chatting with others.

- **Computer Resource Centers**

Alliance for Technology Access -- Special Technology Center
590 Castro Street, Mountain View, CA 94041
(510) 528-0747 or (415) 961-6789
AND
1307 Solano Avenue, Albany, CA 94706-1888
(415) 528-0747 voice and TTY; (510) 528-0746 FAX

They can refer you to a local center where you can go to try out adaptive computer equipment. Operates throughout the United States.

Assistive Device Center
6000 J Street, Sacramento, CA 95819-2694
(916) 278-6422

Assistive Technology Center
Santa Cruz County Easter Seal Society
621-A Water Street, Santa Cruz, CA 95060
(408) 427-3360

California State University at Los Angeles
Disabled Students Computer Laboratory
(213) 343-4860

Center for Applied Special Technologies
(508) 531-8555

Council for Exceptional Children
Center for Special Education Technology
Information Exchange; Technology Media Division
1920 Association Drive, Reston, VA 22091
(703) 620-3660

Center for Special Education Technology
The Robarts School, 1090 Highbury Avenue,
Box 7300, Station E, London, Ontario N5Y 4V9 Canada
(519) 659-1655; (519) 659-1656; (519) 659-1657 FAX

Center for adaptive computer training and equipment recommendations.

Children's Hospital at Stanford
Rehabilitation Engineering Center
520 Sand Hill Road, Palo Alto, CA 94304
(415) 853-3345

Computer Access Center
2425 16th Street, Room 23, Santa Monica, CA 90405
(310) 450-8827

Computer Access Center for Visually Impaired
Mary Washington College, Fredericksburg, VA 22401
(703) 899-4612

CUE Softswap
P.O. Box 271704, Concord, CA 94527-1704
(415) 685-7289

Disability Access Network
P.O. Box 6541, San Rafael, CA 94903-0541
(415) 499-3877

Disabled Children's Computer Group (DCCG) with Disabilities
2547 8th Street, Suite 12-A, Berkeley, CA 94710 or 2095 Rose Street, 1st Floor, Berkeley, CA 94709
(510) 841-3224

East Los Angeles Occupational Center
Disabled Computer Training Program
2100 Marengo Street, Los Angeles, CA 90033
(213) 223-1283

Educational Technology FrEd Mail System
The Department of Educational Technology, San Diego State University, San Diego, CA 92182-0311
(619) 594-3428

Federation for Children with Special Needs
95 Berkeley Street, Suite 104, Boston, MA 02116
(617) 482-2915 voice; (617) 695-2939 FAX

This is the headquarters of a national network of parent training and information centers serving families of children with disabilities. Conducts assistive technology assessments.

High Tech Center for the Disabled
California Community Colleges Training Unit
Foot Hill - DeAnza Community College District
21050 McClellan Road, Cupertino, CA 95014
(415) 949-7777

Human Interaction Research Institute
Region IX Regional Information Exchange
1849 Sawtelle Blvd., Suite 102, Los Angeles, CA 90025
(213) 479-3028

International Braille and Technology Center for the Blind
National Federation of the Blind
1800 Johnson St., Baltimore, MD 21230
(410) 659-9314

Jewish Guild for the Blind
15 West 65th Street, New York, NY 10023
(212) 769-6331

Offers computer courses.

Martin Information Services
87 Shelbourne Road, Rochester, NY 14620
(716) 244-5615

Provides training and consultation on adaptive equipment for visually impaired users.

National Lekotek Center
(800) 366-7529

Offers the CompuPlay Program in which disabled children can learn to use adaptive computers. They also maintain a free lending library.

Project LINK
Center for Assistive Technology
515 Kimball Tower, University at Buffalo, Buffalo, NY 14214-3079
(800) 628-2281

Maintains a free information service to help people learn about assistive products and where to get them.

Project Threshold
Norwalk or Downey, CA
(310) 940-8116

Adaptive technology evaluation lab for persons who are physically disabled. Persons must be referred by the California State Department of Rehabilitation.

Rancho Los Amigos Hospital
Downey, CA
(310) 940-6800

The Center for Applied Technology (CART) will assess adaptive computer equipment needs for persons who are physically disabled.

Rehabilitation Research and Training Center on Blindness and Low Vision
P.O. Drawer 6189, Mississippi State, MS 39762
Voice: (601) 325-2001; FAX: (601) 325-8989; TDD: (601) 325-8693

Resources in Special Education (RISE)
650 Howe Avenue, Suite 300, Sacramento, CA 95825
(916) 641-5925

Santa Monica Junior College
Computer Access Center at John Adams Junior High School
2425 16th St., Room 23, Santa Monica, CA 90405
(310) 450-8827

Provides instruction in computer use to persons who are physically disabled. The Center is available for outside persons to test-run equipment. No evaluations provided.

Sensory Access Foundation
385 Sherman Avenue, Suite 2, Palo Alto, CA 94306
(415) 329-0430

Vocational placement services for persons who are blind or partially sighted, including help writing resumes and interviewing. Training is provided for computer equipment purchased through them. OPTACON loan program. Has two newsletters.

Smith-Kettlewell Eye Research Institute
2232 Webster Street, San Francisco, CA 94115
(415) 561-1620

Provides research and development of sensory aids.

Special Awareness Computer Center
2975 North Sycamore Drive, Simi Valley, CA 93065
(805) 582-1881

Special Technology Center
590 Castro Street, Mountain View, CA 94041
(415) 961-6789

Team of Advocates for Special Kids
100 West Cerritos, Anaheim, CA 92805
(800) 733-8275; (714) 962-6332 or (714) 533-8275

Parent training and information center serving families of children with disabilities. Conducts assistive technology assessments.

Technical Assistance Resource Center
1101 Connecticut Avenue, NW, Washington, DC 20036
(202) 857-1140 voice and TTY

Will refer you to the center nearest you which can help persons with disabilities understand and use assistive technology.

Trace Research and Development Center on Communication, Control, & Computer Access for Handicapped Individuals
Rehab Engineering Center (REC) on Access to Computers and Electronic Equipment
University of Wisconsin - Madison, S-151 Waisman Center, 1500 Highland Avenue, Madison, WI 53705-2280
(608) 262-6966 voice; (608) 263-5408 TTY; (608) 262-8848 FAX

Maintains the TraceBase database files on computer equipment for persons who are disabled, which comes on CD. "Project Info-Curbcuts" is examining access to the Internet by persons with disabilities.

UCLA Intervention Program for Handicapped Children
1000 Veteran Avenue, 23-10 Rehabilitation Center, Los Angeles, CA 90024
(213) 825-4821

Visually Impaired Center
725 Mason Street, Flint, MI 48503
(313) 235-2544

Teaches independent living techniques and offices skills with emphasis on adaptive computer equipment.

Washington Technology Access Center
8705 232nd Place SW, Edmonds, WA 98026

Western Center for Microcomputers in Special Education, Inc.
1259 El Camino Real, Suite 275, Menlo Park, CA 94025
(415) 326-6997

Westside Center for Independent Living
12655 W. Washington Blvd., Suite 101, Los Angeles, CA 90066
(310) 390-3611

Computer access training center for persons who are physically disabled.

Resources

- **Spectrum Press:** Offers fiction, nonfiction titles on PC and Mac disks. All disks include a special program file for easy recovery of ASCII text for use with speech synthesizers. Prices range from $5.95 to $9.95. Spectrum Press, 3023 North Clark Street, #109, Chicago, IL 60657; (800) 606-1419 or E-mail 73774,2733@Compuserve.com or specpress@aol.com

- **The Computerized Braille Tutor:** A public domain disk designed to provide Braille instruction and practice in learning the literary Braille code. It is designed for DOS or Windows environments. The computer keyboard will be used to produce both Braille and typed text. Contact: Research and Development Institute, 1732 Raintree, Sycamore, IL 60178.

- *Windows from the Keyboard*: A practical guide that shows how to operate Microsoft Windows using only the keyboard as an input device. It is available in a four-volume Braille edition for $16.95 Contact: National Braille Press, 88 St. Stephens Street, Boston, MA 02165; (617) 266-6160 Voice; (617) 437-0456 FAX.

- *Perfect Scribe*: Available in Braille, print, disk, and large print. Contains 11 short lessons that present the basic information on the use of WordPerfect 6.0 for DOS. Contact: ARTS Computer Products, Inc., P.O. Box 604, Cambridge, MA 02140, (617) 547-5320; FAX (617) 547-5559.

- **AFB on Internet:** Gopher.afb.org 5005: Designed to provide a wide range of information services to people who are blind or visually impaired; their families, friends, and teachers; professionals; and the general public.

- *Speaking Language Masters*: A fully speaking electronic dictionary, thesaurus, and spelling corrector. Contact: Franklin Electronic Publishers, 122 Burrs Road, Mount Holly, NJ 08060; (609) 261-4800; FAX (609) 261-2984.

- *The CD-ROM Advantage for Blind Users*
  National Braille Press
  88 St. Stephens Street
  Boston, MA 02115
  (617) 266-6160; FAX (617) 437-0456

This reference guide describes CD-ROM technology, how it works with speech and Braille, and lists titles accessible with Braille and speech.

- Recording for the Blind and Dyslexic (RFB&D)
  20 Roszel Road
  Princeton, NJ 08540
  (800) 221-4792; (609) 452-0606; FAX (609) 987-8116

E-Text, RFB&D's collection of electronic books on disk in ASCII text for PCs and Macintosh, includes computer manuals and reference books available for purchase.

- Assistive Devices for Reading
  National Library Service for the Blind and Physically Handicapped (NSL)
  1291 Taylor Street, Nw
  Washington, DC 20542
  800-424-8567 (or 8572) (Reference Section); (202) 707-5100;
  FAX (202) 707-0712

Reference circular lists devices that enable individuals with visual or physical disabilities to gain access to print information.

- *Adaptive Technologies for Learning and Work Environments* by
  Joseph J. Lazzaro
  American Library Association
  Customer Service
  155 North Wacker Drive
  Chicago, IL 60606
  (800) 545-2433

This book explores adaptive technology designed for use by individuals with disabilities, including blindness and visual impairments. It focuses on personal computer hardware and software and applications such as computer networks, on-line services, and CD-ROM.

- *The Handbook of Assistive Technology* by Gregory Church and Sharon Glennen
  Singular Publishing Group, Inc.
  4284 41st Street
  San Diego, CA 92015
  (800) 521-8545; FAX (800) 774-8398

Provides an overview of funding and adaptive access including speech and Braille. Offers suggestions for integrating assistive technology in the community and in the classroom.

- *Solutions: Access Technologies for People Who Are Blind* by Olga Espinola and Diane Croft
  National Braille Press
  88 St. Stephens Street
  Boston, MA 02115
  (617) 266-6160; FAX (617) 437-0456

Describes adaptive computer devices, bulletin board, and publications.

- *Technology Update*
  Sensory Access Foundation
  385 Sherman Avenue, Suite 2
  Palo Alto, CA 94306
  (415) 329-0430; FAX (415) 323-1062

A newsletter that describes recent developments in technology for users who are visually impaired or blind.

- *The Internet Complete Reference*
  National Braille Press
  88 St. Stephens Street
  Boston, MA 02115
  (800) 548-7323

Limited supply Braille edition of a comprehensive guide for beginner or advanced Internet users.

- *Another Source for Books: Electronic Text*
  Reference Section: NLS
  Library of Congress
  Washington, DC 20452
  (202) 707-9275; FAX (202) 707-0712
  E-mail: nls@loc.gov
  URL: http://cweb./oc.gov/nls/n/s.htm/

List of Internet sites that have large collections of full text and public domain books.

- *Sources of Products for Blind and Visually Impaired Persons*
  American Foundation for the Blind
  11 Penn Plaza, Suite 300
  New York, NY 10001
  (212) 502-7642; FAX (212) 502-7773
  E-mail: techctr@afb.org

A directory of assistive devices and their sources.

- *The Trace Resource Book and the Hyper-ABLEDATA Database on CD-ROM*
  The Trace Research and Development Center
  University of Wisconsin
  Madison S-151 Waisman Center
  1500 Highland Avenue
  Madison, WI 53705

Descriptions of technologies for person with visual disabilities as well as contact information for vendors.

- Easy DOS Utilities: A collection of eighteen speech friendly, easy to use, DOS utilities to assist the computer user in accomplishing everyday DOS applications. Comes with free technical support.
  (800) 484-9586, Ext. 9579 or (303) 936-2188. E-mail: philscov@netcom.com

- DO-IT
  Sheryl Burgstahler, Ph.D., Director
  University of Washington
  4515 15th Avenue, NE, Room 206
  Seattle, WA 98105-4527
  (206) 685-3648; FAX (206) 685-4045
  URL: http://weber.u.washington.edu/~doit/

Students with disabilities are given personal computers with the necessary hardware and software to use in their homes. Connects high school and college students with disabilities together.

- The Clearinghouse for Subject-Oriented Internet Resources Guides: Access to data collections of documents and other resources compiled by topic. The Clearinghouse can be reached through the anonymous FTP by connecting UNA.Htl.LIB.UMICH.EDU and looking under the directory/inetdirsstacks; or through Gopher by connecting to GOPHER.LIB.UMICH.EDU and looking under "What's New and Featured Resources" and then under "clearinghouse."

- *Assistive Technology Sourcebook*
  RESNA Press
  1101 Connecticut Avenue, NW, Suite 700
  Washington, DC 22036
  (202) 857-1199

Provides resources for matching technology to individual needs and addresses assessment, reimbursement and service delivery.

- Alex: A catalogue of Electronic Texts on the Internet.
  It can be found at gopher://rs/.ox.ac.vk:70/11/lib-corn/hunter or by pointing your Gopher client at rsl.ox.ac.vk, choosing "Librarian's Corner" and then "Alex."

References

American Heritage Dictionary of the English language [CD-Rom]. Microsoft Bookshelf (1995).

Anderson-Inman, L. (1993). *Computer-based study strategies for academic success: Empowering students with electronic study tools.* Eugene, OR: Center for Electronic Studying, College of Education, University of Oregon.

Assistive Technology Device, 34 C.F.R. § 300.5 (1996).

Assistive Technology Service, 34 C.F.R. § 300.6 (1996).

Corn, A., Hatlen, P., Huebner, K., Ryan, F., & Siller, M. A. (1995). *The national agenda for the education of children and youths with visual impairments, including those with multiple disabilities.* New York: AFB Press.

Koenig, A. J. (1992). A framework for understanding the literacy of individuals with visual impairments. *Journal of Visual Impairment and Blindness, 86*(7), 277-284.

Lavendar, C., Blythe, G., Montulli, L., & Grobe, M. (1997, May). *Lynx users guide, Version 2.3.7 Beta* [on-line]. Available: http://sunhe.jinr.dubna.su/Linemode/Lynx_users_guide.html

Leventhal, J. D. (1995). Accessing Microsoft Windows with synthetic speech: An overview. *JVIB News Service, 89*(3), 23.

Lewis, R. B. (1993). *Special education technology: Classroom applications.* Pacific Grove, CA: Brooks/Cole Publishing.

Luxton, K. (1990). Training students in adaptive computer technology. *Journal of Visual Impairment and Blindness, 84*(12), 523-525.

Mack, C. (1989). The impact of technology on Braille literacy. *Journal of Visual Impairment and Blindness, 83*, 314.

Rex, E. J., Koenig, A. J., Wornsley, D. P., & Baker, R. L. (1994). *Foundations of Braille literacy.* New York: AFB Press.

Salinger, M. (1995). *TAA newsletter of the technology for all Americans project.* Blacksburg, VA.

S.W.V. Marketing and Media Strategists. (1996). *What is the internet?* [on-line]. Available: http://swv.ie/guide/int1.htm#what

Weld County School District #6. (1994). *Technology goals.* Weld County Public Schools: Greeley, CO.

The Relationship Between Literacy and Employment for Persons with Visual Impairments: A Review of the Literature

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Introduction

In our culture, we assume that literacy is one of the critical factors for success in employment and independent living. Literacy has been defined as the ability to read and write at a level appropriate to the individual's academic potential and the ability to accomplish other functional tasks which require reading and writing (Bard, 1993). Success is typically defined as having employment that is valued by self and others; and through that employment, attaining a sufficient socioeconomic status to live comfortably, pay bills promptly, have savings and retirement, own property, and so forth.

Heal and Rusch (1995), in their study of 2,405 individuals with disabilities, found that out of 35 characteristics examined, the personal characteristics of gender, academic skills, and living skills were the strongest predictors of postsecondary school employment. They also found that those with mild emotional, speech, or learning disabilities had the highest employment levels, followed by individuals with hearing impairments. Likewise, individuals with visual impairments, physical impairments, or mental retardation achieved very similar levels of employment. Wolffe and Wild (1984) conducted a similar study of 304 students with partial vision transitioning out of school. Of the 168 who sought employment, the same factors of gender, academic skills and living skills, as well as attitude toward disability, were most highly correlated with predicting success, although at slightly less significance than Heal and Rusch's study.

For individuals with visual impairments, attainment of literacy skills may be through tactual and/or visual systems, particularly with recent developments in technology and the field of low vision. Although the auditory modality is sometimes included in this list, we are accepting the position of Bard: "Literacy skills are not attained solely through the use of auditory learning. Except in very rare cases, the auditory channel should not be considered as the primary literacy medium" (1993, p. 1). A review of the literature shows that mastery of literacy skills by persons with visual impairments is considered to be both complex and important. The major portion of publications in education of children and youth with visual impairments for the past several decades relates to literacy skills (Rex, 1990).

The literature on adults and vocational success has not indicated the same focus. The majority of the publications we reviewed addressed employment records, including attainment of employment after leaving school. Although there is much written about transition to work, little is research-based (Rex, 1990). Publications on literacy and work seem to evidence the same pattern of tradition and ordinary knowledge rather than empirically validated practice. Lindblom (1979) defines ordinary knowledge as that which is based on "common sense, casual empiricism or thoughtful speculation and analysis."

Thus, the literature we reviewed encompasses articles that may or may not be research-based. We have chosen to examine a broader spectrum of literature for two reasons, specifically: (a) there is a dearth of research and we were left with the choice of extrapolating from children's research, which is somewhat more extensive, or reviewing a small amount of research on such a diversity of topics that this document would present little more than an annotated bibliography; and (b) tradition and politics contribute significantly to practice and, if we are to reject the heretofore ineffective linear model of research-to-practice in favor of a more dynamic and interactive relationship between the two, it is important to examine ordinary thinking. The validation of this thinking suggests direction for research.

Our search began with the education, rehabilitation, psychology, and dissertation databases. Other sources included *Books About the Blind: A Bibliographical Guide to Literature Relating to the Blind* and its subsequent iterations *Blindness, Visual Impairment, Deaf-Blindness: Annotated Listing of the Literature* 1953-1975; *Blindness, Visual Impairment, Deaf-Blindness: Annual Listings of Current Literature*; *Blindness, Visual Impairment, Deaf-Blindness: Semi-Annual Listings of Current Literature*; Semi-annual listing of current literature: Blindness, visual impairment, deaf-blindness. Other important sources were the American Printing House for the Blind's *Annual Research Reports*; American Foundation for the Blind's *Research Bulletins*; newsletters and bulletins of various organizations, and the bibliographies of dissertations, articles, and books. The research staff of the Veterans Administration, the American Printing House for the Blind, the Perkins School for the Blind, and the American Foundation for the Blind were particularly helpful in identifying and locating materials.

Our initial charge was to conduct a meta-analysis of the literature related to literacy and employment, but the dearth of research data would have required combining a limited set of data that have little relationship to each other and are incompatible with most statistical measures. We also attempted to systematically examine the research and other publications on literacy levels related to reading mode and the relationship of these to employment, including selection of mode; range of skills (i.e., modalities for accessing information such as listening vs. tactual; symbolic levels and modes; basic skills such as coding and decoding); services and conditions influencing development of literacy skills; employer/employment requirements; employment factors for placement of persons with visual impairments; and success in employment. In a search of the literature from the early 1900s, we found little research or other publications on many of these topics. Thus, this document has taken on a very different shape, although we would suggest that our initial conceptualization of how to approach this literature review offers a framework for future systematic inquiry into literacy and employment.

As we examined research, case studies, self-reports from experience, position papers, and editorials from the 1930s to the present, three major categories related to literacy and employment emerged: (a) the story of Braille in this country, as well as other modes for accessing information including technology; (b) employer, educator, rehabilitation specialist, and employee perspectives of job success and literacy requirements for success; and (c) work placement, adjustment, and job training issues and practices related to literacy. Although this does not reflect all of the literature on employment and persons who are visually impaired or all of the literature related to literacy, we have attempted to sort out and review primarily literature which addresses the relationship between literacy and employment.

The Story of Braille and Other Modes for Accessing Information

In the United States, literacy skills are considered fundamental for gainful employment and independence. For persons with a visual impairment significant enough to limit their ability to see print, literacy skills are predicated on mastery of Braille and access to materials in Braille. "Braille is indeed a viable equivalent of the print media as used by sighted persons" (Stephens, 1989, p. 288).

The Halifax School for the Blind was the first school in North America to relate Braille directly to employment, applying it to double entry bookkeeping (Fraser, 1908). Although Literary Braille was accepted relatively quickly in Canada, it took a bit longer to become the standard code for tactile materials in the United States, in part due to the debate on the merits of Braille vs. New York Point (Foulke, 1982; Kerney, 1952). Acceptance of a unified code led to an increase in the amount and type of materials available in an accessible medium for tactile readers; and made correspondence and other literacy and communication activities possible across the country.

The introduction of Braille contributed significantly to opening doors for persons who were blind because it offered a means to attain literacy. The code has not been static, however. Since its introduction into the United States, it has undergone frequent review and revisions with a focus on insuring it is as compact and legible as possible. As increasing numbers of individuals with visual impairments use Braille for increasing numbers of purposes, the perspective on what are the important characteristics of the code is shifting. Nemeth (1988) argues that, although compactness and legibility are important characteristics, Braille should also reflect accepted English usage so that the individual with a vision impairment can communicate with peers who are sighted in a way that confirms competence. At this time, many contractions and other forms in the Braille code reverse typical order of words or phrases or otherwise depart from American English print codes. This debate is a small part of the larger debate on Braille form and usage that has been waged with varying intensity since Braille's introduction into the U.S.

In an overview of research and research issues, Rex (1990) stated that most visual impairment research began in the 1960's with a strong educational emphasis. Rex also noted that 3 decades of research addressing Braille and literacy present a variety of topics and research models. According to Rex, the focus of the current research models concern selecting appropriate reading media for literacy. Training professionals to teach Braille in educational and

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rehabilitation settings is another area of current interest. Client and student needs are addressed in research, but the role of literacy skills for gainful employment and the use of Braille for daily job tasks expected for various employment positions have not been discussed.

Quantitative research limitations in visual impairments include access to the population of persons with visual impairments because of geographic distance or because of lack of homogeneity within a single setting. Other educational research models applied to this area of inquiry traditionally included single subject designs which indicate clinical changes, data synthesis utilizing meta-analysis to synthesize results of many similar studies, qualitative designs to observe case studies, and ethnographic research (Rex, 1990).

Literacy and Employment

Research pertaining to adults and literacy has been based on self-reported surveys and official U.S. documents about specific populations. Sample sizes are larger in research on adults with visual impairments and represent a cross sample of the population. One early study with a large sample size was Mikulecky's (1955) National Adult Literacy Survey of 26,000 adults. The study focused on workplace literacy requirements in all types of positions. It was found that basic literacy, such as reading and writing notes, reports, messages, and/or directions is required in most jobs. It was proposed that emphasis be placed on preparing workers to write and read sufficiently for these tasks.

Bauman (1963) interviewed 434 adults who were blind to obtain information about professions of persons with visual impairments. It was revealed that 58.3% of men and 71.4% of women used Braille as their reading medium in the workplace. More than half stated that they used Braille for notes, records, or files. Persons who received career counseling in residential facilities prior to job placement reported that they were most likely to make important use of Braille in the workplace. Additionally, participants in the study stated that access to available and appropriate job information through an agency with emphasis on services to persons who are visually impaired was an important factor in their use of Braille.

Johnson and Hafer (1985), in a study of 1981 Rehabilitation Services Administration data on 3,710 individuals, found that incomes of persons with visual impairments, both men and women, continue to lag behind those of the general population. They also reported that 73% of the women with visual impairments in Illinois were employed in clerical, services, or similar areas while 27% were in professional and managerial positions. From past data such as this and a self-report survey of 109 adults with visual limitations, Gandy (1988) found that education affected earnings. Analysis of the Survey of Income and Education of the Bureau of the Census in 1977 (Kirchner & Peterson, 1979) showed that one third of the working-aged adults with visual impairments were in the workforce.

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They speculated that persons were not in the workforce because of discrimination, discouragement, and disincentive to work. Discrimination may account, in part, for the lack of professionals and clerical positions for persons who are visually impaired or blind, and over-representation in manual occupations.

Current research is showing that students now in grade school who will be in the workforce in the year 2000, will be required to integrate basic Braille and technology to complete job tasks. The research also shows that job positions and job descriptions will be different in the year 2000. DeMario (1990) studied 141 vision professionals and 53 students to identify employment competencies needed by a person with a visual impairment. Results of the survey of employment expectations as reported by employers, college faculty, rehabilitation counselors, and employees determined that they assumed competencies for employment to be personal-social, occupational information, orientation and mobility, communication skills, and daily living skills. This data represents projected work setting demands for the worker in the 1990s.

Roberts (1992) defined reasonable accommodations for the job as adapting the workplace so that people with disabilities can compete with those who are non-disabled. He suggested that rehabilitation professionals should prepare informational materials about workers with visual impairments for prospective employers. He found that the inability to read print materials will negatively affect performance in some jobs and that some jobs are appropriate for adaptations in Braille or computer technology. Rehabilitation should involve compensatory skill training in Braille, computer literacy, and managing needs with a minimum of help in the work situation.

The literature on literacy and employment falls into three areas as related to the worker who is visually impaired. The employer's expectations for literacy in the workplace are presented first because rehabilitation counselors and educators must consider this data when preparing individuals for the workplace of the future. Publications on rehabilitation and education illustrate how education and rehabilitation professionals view the needs of the employer and the employee. Lastly, the research addressing persons who have actually received educational and rehabilitation services and must meet the requirements of the workplace are reviewed.

Employer Expectations

Stone (1958) stated that supervisors are trained to work with normal employees who are responsible, regular, and manageable. Workers want security, recognition, and acceptance. Employers expect productivity and quality within a harmonious work site. As the Director of Safety at the Oldsmobile Division of General Motors in Lansing, MI, Stone stated that everyone in the plant has a specific job, does a fair share of the work, and that placement of employees can make the difference between success and failure. At the time there were

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approximately 2,500 employees with special needs placed on jobs with restricted responsibilities. Rather than adapting jobs or the workplace to accommodate the disability, workers were placed in jobs that avoided demands in areas related to the disability. The pre-existing job was compatible with the workers' abilities without modification. He stated that Oldsmobile's success with the worker with a visual impairment was due to good screening, good on-the-job training, and supervision without concessions.

In the same report, Stone stated that there are three reasons industry hesitates to make jobs available for persons who are blind or visually impaired. According to Stone, most employers believe that persons with visual impairments are insurance risks, will present abnormal problems in human relations, and would not "fit in" at work.

Baxter (1979) wrote that limited public knowledge about the capabilities of persons with visual impairment may contribute to limited job success. Employer prejudice against minority groups and poverty add to the problems of persons who are also blind and competition with workers who are blind or visually impaired is not accepted within the workplace.

Bischoff (1974) discussed employers' assumption that dismissal of a person who is blind or visually impaired for inadequacies on the job is viewed as unacceptable in the public eye. Bischoff also stated that thorough examination of vocational training should be done because of automation and new areas of employment where training does not exist. In addition, Bischoff noted that state agency cooperative arrangements are needed; schools now serve more students with multiple impairments; and new concepts of vocational training are being adopted nationally.

Employer needs (DeMario, 1992) include basic reading skills which are required for daily activities. Although DeMario found that literacy skills were not as important as following directions and accepting job responsibilities, basic literacy requirements included study skills, use of computer technology, and taking notes.

Role of Rehabilitation Counseling and Education

Cutsforth (1951) criticized educators for training the child with a visual impairment or blindness for jobs that were rapidly becoming outdated because of the industrial revolution. McBroom and Seaman (1988) stated that the computerized job matching systems often assume that vision is a requirement. They suggested that vocational counselors search for jobs as if the applicant has good vision and then screen out the jobs where vision is an absolute necessity for job performance. They also suggested that industry revise and update the job requirements so that less emphasis is placed on good vision unless necessary.

Hill (1989) reviewed Rehabilitation Services Administration data on 18,394 individuals who were blind or visually impaired and reported as successfully rehabilitated during fiscal year 1982. He determined that vocational placement is of utmost importance for work status outcomes. The most important indicators of work status at closure were age and sex. The average man was placed in competitive employment whereas the woman was placed as a homemaker. The client's chances of achieving any particular outcome depended primarily on the agency's goals, priorities, and resources.

Gunderson (1952) noted that there was a lack of training materials and specialized measuring instruments in Braille for teaching radio and electronics. An electronics magazine in Braille, published monthly, addressed radio literature education. The electronic problems could be determined with sound and absence of sound or changes in pitch of sound. Gunderson, who was blind, modified teaching materials to meet the needs of students and the instructors in this field.

Pumo (1984) predicted the use of computers and the changes within the workplace that will affect the worker who is blind. He proposed training in the early education setting, continuing education for adult educators, and a database of potential jobs available for the worker who is blind so that training can meet the needs. He suggested that the worker should also be trained in listening skills and provided with necessary computer aids such as large print materials and tactile and auditory output devices. Ponchilla and Durant (1995) surveyed Braille instructors in 136 private and public rehabilitation centers. They reported that instructor beliefs about the importance and process of teaching Braille, cognitive levels that the instructor deemed appropriate for Braille instruction, and motivation to learn Braille determined actual teaching methods used with adults. They found that Braille was not taught to the majority of rehabilitation clients.

Employees' Perspective on Requirements for Vocational Placement

Wolffe, Roessler, and Schriner (1992) surveyed 76 adults who were blind or visually impaired and found that 90% thought job-seeking skills were the most important in job placement. Johnson (1995) correlated workplace empowerment with education in surveying 62 machine shop employees at all levels of employment. Johnson found that persons with low vision had more difficulty in the workplace than persons who were blind. Ryder and Kawelec (1995) reported on job-seeking for adults with visual impairments and the job assistance needed. Their work indicated that provision of necessary tools for note-taking with audio devices and large print materials were of primary importance for potential job success. Independence was gained when participants could demonstrate competence with adaptations for visual tasks.

Mack (1984) surveyed Braille users who learned Braille in school. Thirty adults were involved in the study, 28 of whom learned Braille in public school. Ninety-seven percent primarily used Braille in the workforce to record phone numbers and notes. Of the 30 adults, 20% reported that they used Braille for work-related reading, 17% used readers, 17% used tapes, 6% used Optacon, and

40% did not use reading on the job or in school. Fifty-three percent of the individuals surveyed reported that they used Braille frequently and occasionally at work and at home. The study also indicated that listening skills and typing skills were important as well as Braille reading and writing skills. The need to use listening skills, keyboard skills, and other means of literacy and communication is supported by Koenig's (1992) description of literacy as negotiating successful communication within daily life activities with a specific audience, including one's self, through notes and memos. This proposed description was based on an inventory of three jobs and the audiences with whom the worker most communicated in those three jobs.

In 1988, Kirchner and Greenstein noted that 19% of the 434 persons surveyed in 1984, covering 160 different jobs, were employed in the "profit sector" and 8% were self-employed. The others were employed in rehabilitation, education, and government agencies. They noted that persons in high-status jobs were more likely to use special devices on the job than the low-status job positions. Profit sector employers were less likely to make costly accommodations than those in other job sectors. However, the employers who were willing to offer accommodations typically purchased access and transcription devices, transcribed print into Braille or large print, or assigned clerical help for written materials.

Heiden (1989) reported results from a 10-year follow-up survey of 164 graduates of Wisconsin School for the Visually Handicapped. Eighty-one percent of the students reported that instruction on adaptive devices was most helpful for their work. They also reported that co-curricular activities were important for success in their employment.

According to Bauman (1975), workers who are visually impaired or blind are unsuccessful vocationally because of the lack of involvement in their own career planning. Grossberg and Beyer (1984) presented a single-subject qualitative study concerning a school of social work and training and placement for students who were blind. The basis of the study stemmed from the traditional refusal of social work schools to admit students with vision loss. The school was concerned that students who were blind or visually impaired presented many needs additional to those presented by students with sight in the school setting, during placement, and on the job. One problem noted by the researchers was the assumption that dictation and reading of case materials may require extra time, thus having an effect on the caseload level and the balance within the agency. The student's main concern was travel and mobility within new environments. The student solved the travel problem through utilizing the bus system and traveling with other staff persons.

Record-keeping was completed using a reader for the case reports, filling out forms, and other paper work needs. The student reported that the person with a visual impairment can handle a normal caseload within the agency with the assistance of a reader and a driver. Braille was not mentioned as a daily record-keeping medium.

Salamone and Paige (1984) surveyed 29 present and former clients of the

New Jersey Commission for the Blind and Visually Impaired to explore their experiences while securing work and to identify explanations for successful and unsuccessful vocational outcomes. In reference to literacy in the workplace, it was suggested that individuals with visual impairments or blindness use special equipment to overcome the difficulties of handling paperwork on the job. It was noted that employees who are visually impaired or blind should retain the responsibility for finding solutions to job-related problems.

Mather (1994) stated that the shift to information technology in employment has implications for the types of skills needed on the job. Some workers feel that their jobs have evolved around the technology that may be available in a particular workplace.

Developing or Recapturing Literacy for Adults with Vision Loss

Literacy is a national concern for employers and educators. The term literacy encompasses cultural, computer, mathematical, picture, and graphic literacy. For adults who are newly blinded, however, adjusting to daily situations, learning new ways to complete tasks, establishing routines, and using coping skills were most challenging, according to Allen's (1988) 12-month study of seven adults to assess the process of adjustment to blindness.

The importance of Braille to many persons with blindness and severe visual impairments, however, is evident in this statement by Nemeth (1988):

> "If you were asked to list, in order of their importance, those ideas, inventions, or discoveries which, throughout the ages, have contributed the most to improving the quality of human life, the invention of Braille would surely be somewhere near the top of the list...Braille makes it possible for a blind person to assume a role of equality in modern society, and it can unlock the potential within him to become a contributing member of his community on a par with his sighted fellows." (p. 324)

For many persons who are blind, respect for and emphasis on Braille as the primary mode of literacy has become a metaphor for equality and opportunity. "As professionals develop true beliefs in the competence of blind people and the efficacy of Braille, educational planning will then stress Braille, resulting in a resurgence of literacy for the blind population" (Schroeder, 1989, p. 290). Recently, as an outcome of the controversy regarding the perceived decline in Braille literacy, a great deal of publications, including those that are research-based, have addressed issues related to Braille's importance and value, rehabilitation teachers' and educators' willingness and ability to teach Braille, and the role of low vision and technology in literacy.

Surveys of adults indicate, however, that the issue is not that they do not

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know Braille, but that they do not use it extensively. Perhaps this is not so surprising in light of the often cited statistic that, on the average, adults in the U.S. read less than one book per year. Common knowledge, however, presumes that many persons who are adventitiously blind do not learn Braille, although the basic literacy needs cited by most adults--notes, labels, messages, etc.--are important. Shafrath (1986) proposed using an alternative code, such as the Fishburne alphabet, to enable mastery of basic literacy skills.

Issues of Braille Instruction

Neer (1985), a former reading teacher who began to lose her vision when in her 60s, indicates that a great difficulty with learning Braille is not its complexity as is often assumed. Rather, she says that it is not taught in a way that is motivating or useful to an individual who is newly blinded. According to Rex (1989) there is no research documenting that the code is too complex to learn, only that it may be different from print. Pring (1984) examined semantic processing, word frequency effects, and phonological recoding under normal and reduced legibility conditions. Pring found that the inherent low redundancy of Braille distinguishes it from print in the reading processes; minor misplacement of a dot in Braille is more crucial than gross distortion in print; and although Braille has less redundancy than print in terms of interword consistency, it does have similar intra-word redundancy. Braille readers need to bring to bear compensatory mechanisms directed more toward processing and higher level contextual information.

Rehabilitation teachers and other educators and counselors may want to examine closely the research on whole language approaches and other changes in literacy instruction, and the new thinking about adult learners to ascertain the most effective way to teach Braille to persons with visual impairments. There is much discussion about how to move toward more modern methods of instruction that are relevant to childrens' or adults' learning and development (Swenson, 1991). Swenson's advocacy for new and motivating methods for teaching literacy skills responds to Neer's (1985) assertion that the most modern and motivating methods available be used. Typically, the methods and sequence for teaching a person who is adventitiously blind to read and write Braille are determined by the instructional text that may be used and the instructor's personal characteristics (Ponchilla & Durant, 1995). Sasso and Jones (1983, 1984) looked at teaching Braille to students in residential schools and found there was very little formality in choosing programs and methods of teaching Braille. Methods were often not age appropriate, such as using a primary reading program like Patterns with adolescents. Mangold (1978) looked at developmental teaching of tactile perception and Braille letter recognition. Mangold found that this approach reduced errors in tactile perception and Braille letter recognition; and reduced scrubbing and backtracking.

The literature reports research into the Braille code, how to teach Braille to children, and how children learn to read using Braille. Hamp and Caton (1984) drew the conclusion that the Braille code and principles of Braille reading are not analogous to the print code and principles of print reading. The implications in this for how to teach newly blinded adults who are already readers have not been researched. Rather, research has investigated factors affecting reading efficiency and other dimensions of mastery of the Braille code (Ponchilla & Durant, 1995). Williamson, Allen, and McDonald (1976) compared the reading performances of 15 students who were blind and 15 who were sighted to determine efficiency of gaining meaning. Performance of the Braille readers was radically different from that of the print readers along several linguistic dimensions. Subjects who were blind were not as efficient as the sighted subjects in applying either surface or deep structure to their reading and understanding of the text. Pring (1982, 1985) also looked at higher order processes in Braille such as phonological and tactual coding. Pring reported that input modality and orthographic differences in Braille reading produce different word recognition strategies for readers who are blind or sighted, and differential allocation of attention to levels of word processing between groups of readers. Sowell and Sledge (1986) found that Braille readers' errors on Goodman's reading miscue inventory were more similar to those of print readers than different from the types of errors exhibited by print readers.

Baker, Koenig, and Sowell (1995) looked at correlations between Blind Learning Aptitude Test (BLAT) and oral reading speed, comprehension, grade, years of blindness, intelligence, and achievement. They found that the BLAT correlates more closely to comprehension than to reading speed. Implications for individuals who are adventitiously blind were not addressed.

The Relationship Between Low Vision and Literacy

The relevancy, viability, and vitality of Braille as a medium of literacy has often been challenged, more recently with the evolution of low vision services and devices, and technology (Jernigan, 1982). Ponchilla and Durant (1995) surveyed 136 Braille instructors in Adult Rehabilitation Centers and found that Braille was not taught to a large proportion of adult clients in rehabilitation agencies. This may be, in part, accounted for based on the findings that more than 90% of persons with visual impairments retain a degree of usable vision (Ellis, 1986; Robinson, 1977; Tavernier, 1993). There are increasing publications on the debate over primary reading modes for learners with low vision. Primary reading mode is defined as the one most frequently used by the individual with a visual impairment for reading and writing in a variety of settings (Bard, 1993).

Eaglestein and Rapaport (1991) examined the use of low vision aids by 458 clients of a low vision clinic. They found that it was difficult to predict the type of aid that will be accepted and used according to typical and consistent criteria, although there was some correlation between use of telescopes and telescopic glasses and employment. Older clients were more likely to use a variety of aids. Holbrook and Koenig's (1992) review of methods and materials for parallel instruction and nonparallel instruction to print readers is representative of the decisions that must be faced by the reader and the Braille instructor regarding instruction in print, Braille, or both modes.

The Relationship Between Literacy and Technology as Related to Employment

Paradoxically, the development of the fields of low vision and technology, although perceived as a threat to Braille usage, has also furthered its importance in education and employment of persons who are blind. Dupress (1966) reported on the first computer used to translate print into Braille by the American Printing House for the Blind in May, 1964. In rapid succession, the University of Cincinnati Medical Computing Center modified a computer line printer to produce Braille. By 1966, International Business Machines and Honeywell corporations were concluding development of high-speed Braille printers. Dupress headed a team at Massachusetts Institute of Technology, working under contract to the Vocational Rehabilitation Administration, to develop a lower cost computer that could translate print into grade II Braille. He predicted that a computer could someday receive information in a variety of ways, including over the telephone and translate it into Braille; and that it would be possible for teletypers to simultaneously receive Braille and print copies of the information they were transcribing.

The year 1957 has been documented as the beginning of the information age, based primarily on the fact that it was the first year when the number of white collar jobs equalled blue collar jobs (Naisbitt, 1982). In the year 1950, 17% of the workforce worked with information, whereas in 1982, over 60% worked with information. Futurists predicted that 75% of all jobs would require computers by 1985, whereas others said that at least 60% would by 1990.

Persons who are visually impaired can view the information that people who are sighted see on cathode ray tube screens with magnification. Braille and speech displays serve the same function. The computer has no prejudice or preference. For the first time since the world abandoned the oral tradition of information dissemination in favor of literacy and the written word, people who are blind may achieve equality in access to information because of technology (Scadden, 1984). Scadden asserts that the goal of equality in the information age will continue to be elusive until there are economic, cultural, and rehabilitation/educational changes.

Toffler (1980) cited emerging employment patterns: electronics and computer industry becoming one of the largest in the world. He identified growth trends in other high technology fields such as the space industry, oceonographics, and biological engineering, all of which would need knowledgeable workers.

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Persons with visual impairments can compete equally with proper training, education, access and equipment (Scadden, 1984). Scadden thinks that the new economy appears to reflect a changing social order in which, as individuality and diversity are more accepted, societal attitudes toward persons who are blind or visually impaired should become more flexible.

As computer use in industry, government, and education increases, interaction of the development of computer technology for Braille production and for other purposes will expand opportunities for a person with blindness to enter into and compete in the employment arena, and increase the availability of materials in Braille. Stephens (1989) wrote "Through advances in technology, it is possible to do word processing in Braille. In fact, the ability to edit Braille text accurately and then convert it into hard copy print is one of the most significant advances in communication available to blind persons in this century." (p. 288) Dupress' (1966) reminder of the necessity to insure access to charts and other graphics and pictures for persons who are blind as a challenge to full literacy competence is still timely today.

Perhaps of most interest to employers and rehabilitation counselors is the significant boost in productivity with the introduction of voice output for computers. The growth of technology, rather than supplementing literacy skills for persons with visual impairments, increases the demand for technology, particularly as it enables independence from a reader (Bruncken, 1984; Mack, Koenig, & Ashcroft, 1990). For example, appropriate equipment and word processing capability, although opening doors to new employment opportunities, also require refinement of proof-reading and editing skills. With the availability of technology, productivity expectations are based on work load and industry mores, without adjustment to a reader's schedule; and independence in scanning, note-taking, outlining, and other organizational skills are expected of the individual. The proliferation of technology, however, is significantly enhancing opportunities for persons with visual impairments and blindness, perhaps more than for any other group (Scadden, 1987). Most importantly, technology can insure that people who are blind will have access to the information that is both necessary for full participation in society and is available only through participation, assuming they have the literacy skills to take advantage of it (Bhargava & Goel, 1988). Computers and other forms of technology as more widely employed tools for writing and composing, will come to offer more advanced composing functions for people who are blind, but are not a panacea for all. For example, the process of writing on the computer using text access capability places extreme demands on memory (Ely, 1983).

Literacy includes technology: Technology exists to allow for computer output in alternative forms of literature, including Braille, large print, or synthetic speech. Thus, training in the use of this adaptive technology is seen as a critical stepping stone to the all-important first job. Adaptive technology plays a role in performance of a myriad of jobs previously thought inaccessible because of their high dependence on paperwork (Luxton, 1990). Luxton argues that technology is

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an important component of literacy and it is important to take an educational approach to adaptive computing--teaching students to use adaptive computing to realize their own strengths and interests as opposed to only training in a specific piece of equipment for a particular purpose. Luxton argues that adaptive technology can further literacy.

The level and quality of services for training adults in technology varies significantly and there are issues such as accessibility, staff training, or client access to equipment upon return to work, that affect the nature, content, and quality of training (Wischkin, 1987). Word processing has been the most frequently discussed technology-related function in the literature. Mercer, Correa, and Sowell (1995) reviewed the literature on word processing for persons with low vision or blindness. Though they found little research, most of which were non-empirical case studies, the literature they reviewed indicated generally positive outcomes, with slight variations related to motivation, creativity, facilitation of composition, editing, and increasing length of output.

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Conclusions and Recommendations

Case studies appear to be the preferred methodology for vision professionals over the last 40 years. Those studies which involved sufficient sample sizes to use quantitative design and methodology predominantly involved graduates of the residential schools for individuals with visual impairments. Although they looked at a variety of issues related to both employment and literacy, they have not looked at the relationship between literacy and employment. Although there is presumed to be a relationship between literacy and success in the workplace, we were unable to identify any studies addressing a correlation between literacy levels and successful employment.

Census data have been reviewed by several researchers as a source of extensive workplace and job information, including characteristics, requirements, conditions, etc. of classes of occupations. An analysis of the nature and extent of literacy demands for these would be invaluable for development of curricula and instruction for vocational preparation of adolescents and adults who are congenitally or adventitiously blind.

The limitations and strengths of the research are apparent when one reviews the literature. Along with limited subject pools, many studies have had very narrow foci. For example, reading rates have been a component of much of the research on Braille reading, but the relationship between rate and comprehension has not been explored; neither has rate, comprehension, or other dimensions of effectiveness and efficiency been examined in relation to the type/source of the Braille (i.e., paper, thermoform, refreshable) or in relation to alternative access to print (e.g., voice access to a computer screen). It is not necessary to echo the recommendations of other researchers, most of whom are cited in this document, who have called for reform in the scope and nature of the research related to persons with visual impairments and blindness. The reader need only raise his/her own questions to recognize the dearth of validation and verification in the field of literacy and employment.

It is recommended that particular attention be paid to the practitioner as a conductor and a consumer of research. Case studies demand replication to increase the scope of their impact on practice. This requires an action research model that, by definition, is best implemented by practitioners. Closer attention to other aspects of the technology of qualitative research should be paid, particularly grounded theory and program evaluation. Qualitative research would enable us to deepen and clarify our ordinary knowledge, as defined by Lindblom (1979) so as to validate our suspicions about practices as effective or ineffective, and generate theories which we may want to test empirically. Careful application of the principles and methodologies of applied behavioral analysis research would also support an inquiry into the efficacy of our practice. Pre-service curricula in training institutions that are preparing personnel for the variety of professions serving persons with visual impairments or blindness should require action research as part of all practica or internship experiences. At the same time, national organizational meetings and conferences should have seminars on the variety of research technologies that are available besides traditional quantitative empirical models, which are inherently inappropriate for a population that is small and heterogenous; and which are often too limiting for inquiry into theories and practices with the kind of historical and political grounding that much of our education and rehabilitation services represent. Research that is carried out--and that needs to be replicated, questioned, challenged, and/or celebrated--is applicable to practice only through the efforts of rehabilitation teachers or other practitioners. Thus, not only must we encourage and support this group to conduct their own research, we must incorporate the results of others' research into in-service training models and staff development models offered to these professionals.

Most constituents--employers, consumers, instructors, counselors, teachers, and family members--can agree that literacy skills are important for successful employment. It is the nature of those literacy skills and their political and practical implications where the debate rages. In considering the importance of literacy skills in the U.S., perhaps the clearest conclusion one can draw at this stage is the importance of looking carefully at the available options for adults with visual impairments or blindness, and the literacy demands and support these options present (Mack, 1984). It is this consideration of the options and the current state of knowledge that should drive our research and our practice in the future (Rex, 1990).

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References

Allen, M. (1988). Adjustment of adults to a visual impairment: Preliminary findings. In Baine, David et al. (Eds.), *Alternative futures for the education of students with severe disabilities.* (ERIC Document Reproduction Service No. ED 310572)

Ashcroft, S. C. (1960). *Reading of Braille at elementary grade level.* Unpublished doctoral dissertation, University of Illinois at Urbana-Champaign.

Baker, C., Koenig, A., & Sowell, V. (1995). Relationship of the blind learning aptitude test to Braille reading skills. *Journal of Visual Impairment and Blindness, 89*(5), 440-447.

Bard, J. (1993). *Literacy for students with visual impairments* (Document No. 512011011). Harrisburg, PA.: Pennsylvania Department of Education.

Bauman, M. K. (1963). *Characteristics of blind and visually handicapped people in professional, sales, and managerial work.* Harrisburg, PA.: Pennsylvania Office for the Blind, Department of Public Welfare.

Bauman, M. K. (1975). Guided vocational choice. *New Outlook for the Blind, 69*, 354-360.

Baxter, N. (1979). Disabled workers and the career counselor. *Occupational Outlook Quarterly, 23*(3), 3-11.

Bhargava, M., & Goel, S. (1988). Communication media and information technology in aid of visually handicapped. *Psycho-lingua, 18*(1), 11-21.

Bischoff, R. W. (1974). Problems of employment for the visually handicapped. *The Utah Eagle, 85*(6), 7-9.

Bruncken, P. (1984). Independence for the visually handicapped through technology. *Education of the Visually Handicapped, XV*(4), 127-133.

Cutsforth, T. D. (1951). *The blind in school and society.* New York: American Foundation for the Blind.

DeMario, N. (1990). *Non-academic competencies for elementary level students with visual impairments.* (ERIC Document Reproduction Service No. ED 321460)

DeMario, N. (1992). Skills needed for successful employment: A review of the literature. *RE:view, 24*(30), 115-125.

Dupress, J. (1966). Braille research and development: Progress and predictions. *International Journal for the Education of the Blind, 15*(3), 74-78.

Ellis, D. (1986). *Sensory impairments in mentally handicapped people.* London: Croom-Helm.

Ely, R. (1983). Writing, computes and visual impairment. *Journal of Visual Impairment and Blindness, 83*(5), 248-252.

Foulke, E. (1982). Reading Braille. In W. Schiff and E. Foulke (Eds.), *Tactual perception: A sourcebook* (pp. 168-208). New York: Cambridge University Press.

Fraser, C. F. (1908). *Commercial training of the blind.* Halifax, Nova Scotia: Halifax School for the Blind.

Gandy, M. J. (1988). The impact of education on the earnings of rehabilitation clients. *Education of the Visually Handicapped, 20*(1), 13-21.

Grossberg, S. H., & Beyer, B. L. (1984). Field instruction with blind students. *Social Work Education of the Blind, 20*(1), 60-63.

Gunderson, R. (1952). Radio theory and practice for the blind. *International Journal for the Education of the Blind, 1*(4), 89-93.

Hamp, E., & Caton, H. (1984). A fresh look at the sign system of the Braille code. *Journal of Visual Impairment and Blindness, 78*(5).

Heal, L., & Rusch, F. (1995). Predicting employment for students who leave special education high school programs. *Journal of Exceptional Children, 61*(5), 482-487.

Heiden, J. M. (1989). A ten-year follow-up study of former students at the Wisconsin School for the Visually Handicapped: 1978-1987. *RE:view, 21*(2), 81-87.

Hill, M. A. (1989). Work status outcomes of vocational rehabilitation clients who are blind or visually impaired. *Rehabilitation Counseling Bulletin, 32*(3), 219-230.

Holbrook, M., & Koenig, A. (1992). Teaching Braille reading to students with low vision. *Journal of Visual Impairment and Blindness, 86*(1), 44-48.

144

Jernigan, K. (1982, May). Braille: Changing attitudes, changing technology. *The Braille Monitor,* 163-170.

Johnson, G. M. (1995). Vision, educational level, and empowering work relationships. *Journal of Visual Impairment and Blindness, 89*(2), 112-119.

Johnson, S., & Hafer, M. (1985). Employment status of severely visually impaired men and women. *Journal of Visual Impairment and Blindness, 79*(6), 241-244.

Kerney, E. (1952). First tidings of literary Braille in North America. *International Journal for the Education of the Blind, 2*(1), 112-118.

Kirchner, C., & Peterson, R. (1979). Statistical Brief #5. *Journal of Visual Impairment and Blindness, 73*(6), 239-242.

Kirchner, C., & Greenstein, Z. (1988). Networks for employment of blind/visually impaired persons: A review, with findings from AFB's Job Index. In C. Kirchner (Ed.), *Data on blindness and visual impairments in the U.S.: A resource manual on social demographic characteristics, education, employment and income, and service delivery* (2nd ed.). New York: American Foundation for the Blind.

Koenig, A. J. (1992). A framework for understanding the literacy of individuals with visual impairments. *Journal of Visual Impairment and Blindness, 86*(7), 277-284.

Lindblom, C. (1979). Still muddling, not yet through. *Public Administration Review, 39*(6), 517-526.

Luxton, K. (1990). Training students in adaptive computer technology. *Journal of Visual Impairment and Blindness, 84*(12), 523-525.

Mack, C. (1984). How useful is Braille? Reports of blind adults. *Journal of Visual Impairment and Blindness, 78*(7), 311-313.

Mack, C., Koenig, A., & Ashcroft, S. (1990). Microcomputers and access technology in programs for teachers of visually impaired students. *Journal of Visual Impairment and Blindness, 84*(10), 526-530.

Mangold, S. (1978). Tactile perception and Braille letter recognition: Effects of developmental teaching. *Journal of Visual Impairment and Blindness, 72*(9), 259-266.

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Mather, J. (1994). Computers, automation, and the employment of persons who are blind or visually impaired. *Journal of Visual Impairment and Blindness, 88*(6), 544-549.

McBroom, L. W., & Seaman, J. (1988). Evaluation of computerized job matching systems' responsiveness to persons who are visually impaired. *Vocational Evaluation and Work Adjustment Bulletin, 21*(4), 139-147.

Mercer, D., Correa, V., & Sowell, V. (1995). Teaching visually impaired students word processing competencies: The use of the viewscan textline. *RE:view, 22*(1), 17-29.

Mikulecky, L. (1955). Workplace literacy: Employment issues for the adult learner with learning disabilities. *Linkages, 2*(1), 1-2.

Naisbitt, J. (1982). *Megatrends.* New York: Warner Books.

Neer, F. (1985). A reading teacher learns to read Braille. *Journal of Visual Impairment and Blindness, 79*(5), 208-209.

Nemeth, A. (1988, July). Braille: The agony and the ecstacy. *The Braille Monitor*, 324-328.

Ponchilla, P. A., & Durant, P. A. (1995). Teaching behaviors and attitude of Braille instructors in adult rehabilitation centers. *Journal of Visual Impairment and Blindness, 89*(5), 432-439.

Pring, L. (1982). Phonological and tactual coding of Braille by blind children. *British Journal of Psychology, 73*(4), 351-359.

Pring, L. (1984). A comparison of the word recognition processes of blind and sighted children. *Child Development, 55*, 1865-1877.

Pring, L. (1985). Processes involved in Braille reading. *Journal of Visual Impairment and Blindness, 79*(6), 252-254.

Pumo, B. J. (1984). The future is now: Preparing the blind and visually impaired for employment in the computer age. *Journal of Visual Impairment and Blindness, 73*(3), 122-123.

Rex, E. (1989). Issues related to literacy of legally blind learners. *Journal of Visual Impairment and Blindness, 83*(6), 306-313.

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Rex, E. (1990). The education of visually handicapped learners: An overview of research - research issues. *Peabody Journal of Education, 67*(2), 54-73.

Roberts, A. H. (1992). Looking at vocational placement for the blind - A personal perspective. *RE:view, 23*(4), 177-184.

Robinson, G. C. (1977). Causes, ocular disorders, associated handicaps and incidence and prevalence of blindness in childhood. In J. E. Jan, R. D. Freeman, & E. P. Scott (Eds.), *Visual impairment in children and adolescents* (pp. 27-47). San Francisco: Grunt and Straighten.

Ryder, B. E., & Kawalec, E. S. (1995). A job-seeking skills program for persons who are blind or visually impaired. *Journal of Visual Impairment and Blindness, 89*(2), 107-111.

Salamone, P. R., & Paige, R. E. (1984). Employment problems and solutions: Perceptions of blind and visually impaired adults. *Vocational Guidance Quarterly, 33*, 147-156.

Sasso, C., & Jones, T. (1983). Instructional procedures and reading materials used with visually impaired students. *Education of the Visually Handicapped, 15*(3), 75-85.

Sasso, C., & Jones, T. (1984). A survey of approaches to teaching reading to visually impaired students in residential schools. *Journal of Visual Impairment and Blindness, 78*(6), 263 264.

Scadden, L. (1984). Blindness in the information age: Equality or irony? *Journal of Visual Impairment and Blindness, 78*(11), 394-400.

Scadden, L. (1987). Impact of technology on visually impaired children and youth. In E. P. Connor (Ed.), *Critical issues for low incidence populations* (pp. 43-59). Reston, VA: Council for Exceptional Children.

Schroeder, F. (1989). Literacy: The key to opportunity. *Journal of Visual Impairment and Blindness, 83*(6), 290-293.

Shafrath, M. (1986). An alternative to Braille labeling. *Journal of Visual Impairment and Blindness, 80*(11), 955-956.

Sowell, V., & Sledge, A. (1986). Miscue analysis of Braille readers. *Journal of Visual Impairment and Blindness, 80*(12), 989-992.

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Stephens, O. (1989). Braille -- Implications for living. *Journal of Visual Impairment and Blindness, 83*(6), 288-289.

Stone, J. R. (1958). Industry looks at the blind. *International Journal for the Education of the Blind, 8*(2), 52-58.

Swenson, A. M. (1991). A process approach to teach Braille writing at the primary level. *Journal of Visual Impairment and Blindness, 85*(5), 217-221.

Tavernier, K. (1993). The improvement of vision by vision stimulation and training: A review of the literature. *Journal of Visual Impairment and Blindness, 87* (5), 143-148.

Toffler, A. (1980). *The Third Wave.* New York: Morrow.

Williamson, L., Allen, S., & McDonald, B. (1976). *Braille reading is less efficient than visual reading.* (ERIC Document Reproduction Service No. ED 124870)

Wischkin, D. (1987). A national survey of computer curricula. *Journal of Visual Impairment and Blindness, 81*(10), 392-393.

Wolffe, K. E., Roessler, K. F., & Schriner, K. F. (1992). Employment concerns of people with blindness or visual impairments. *Journal of Visual Impairment and Blindness, 86*(4), 185-187.

Wolffe, M., & Wild, J. M. (1984). The occupational success of visually handicapped adolescents in the first year after leaving school for the partially seeing. *International Journal of Rehabilitation Research, 7*(4), 399-407.

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