

Visual Assessment of Hearing-Impaired Persons: Options and Implications for the Future

Donald D. Johnson and Frank Caccamise
National Technical Institute for the Deaf (NTID)
Rochester Institute of Technology (RIT)

The need for persons working with hearing-impaired people to learn more about identifying visual problems and optimizing the use of vision by *all* hearing-impaired students/clients is stressed. The current process for identifying National Technical Institute for the Deaf (NTID) students who do and do not have visual problems is described. Also, problems and needs of visually/auditorially-impaired people, and professionals working with them, are discussed. In addition, research needs relative to visual assessments/examinations and academic/career, personal/social, and communication planning and follow-up are identified.

For persons who are deaf, good vision becomes paramount for learning, communication, mobility, recreation, social interaction, and vocational pursuit. Good vision is particularly important to the educational process of the deaf child. (Barrett, 1979, p. 745)

Approximately 99 percent of information is acquired through the sensory modalities of vision and audition (Hicks & Pfau, 1979). Thus, impairment of both the visual and auditory modalities impedes the learning process and significantly influences the educational or rehabilitative program required, fostering an array of learning, methodological, social, psychological, and career implications for students. It is therefore important to assess the integrity of both the visual and auditory mechanisms in early infancy and at regular intervals thereafter.

Regarding assessment of the visual mechanism, the National Society to Prevent Blindness (NSPB, 1972, p. 20) stated:

A complete, competent, professional eye examination for every child before entering school and at stated strategic intervals during school life is the ideal

Donald D. Johnson, Ph.D. is a Professor of Audiology in the Communication Program, National Technical Institute for the Deaf (NTID), Rochester Institute of Technology (RIT), Rochester, New York, 14623. Frank Caccamise, Ph.D. is a Research Associate, Communication Program, NTID, RIT.

goal. Until this goal is attained, vision screening programs during the preschool years are necessary to identify children who may be in need of eye care, so they can be directed toward adequate professional attention. Statistical studies show that 25% of children of school age may have some eye difficulty which may require professional care. If a student has poor vision and this fact is not known, the difficulty may affect his learning abilities and entire adjustment in school.

The incidence of hearing-impaired students with visual impairments is higher than that of the general school-age population. Campbell, Polomeno, Elder, Murray, and Altosaar (1981) summarized several studies that reported visual impairment incidence rates ranging from 38% to 58% among hearing-impaired students. Johnson, Caccamise, Rothblum, Hamilton, and Howard (1981) reported that the estimated incidence of visual impairments among the 620 students entering the National Technical Institute for the Deaf (NTID)¹ during 1978 and 1979 was 65% when both pathological and functional visual problems (i.e., problems of far visual acuity, color deficiency, and binocular vision) were considered.

Timing is of the utmost importance in treating visual problems if unnecessary permanent physical and/or functional visual impairments are to be avoided. For example, amblyopia is any reduction in visual acuity in one or both eyes, not correctable by refractive means (glasses/contact lenses), and not attributable to obvious structural or pathological ocular anomalies (NSPB, 1972). The most common cause of amblyopia is faulty alignment of the two eyes causing a person to see double. Amblyopia, if treated before the age of six years, may not present a permanent reduction in vision since correction may be possible through glasses, patching, surgery, or a combination of procedures including eye exercises. Johnson and Caccamise (in press) reported that of the 289 students entering NTID in 1981, nine were found to have irreparable amblyopia where one eye was not able to be corrected to better than 20/100 or 20/200. It is possible that these permanent eye problems may have been prevented if the problems had received adequate attention at the appropriate time.

Further, it is inappropriate to assume that visual problems of hearing-impaired students, when correctable, will have received appropriate professional attention by the time the student has reached young adulthood. Of the 289 students entering NTID in Summer 1981, 41 (14.2%) were referred for on-campus ophthalmological examinations for suspected far visual acuity problems. Of these 41 students, 20 were 20/40 or poorer in one or both eyes with their present correction, and the other 21 were in possible need of a first correction for previously undetected far visual acuity problems.

Leading causes of visual impairment among older persons are glaucoma,

¹NTID is one of the ten colleges of RIT. As sponsoring institution, RIT provides the opportunity for NTID students to pursue postsecondary programs together with hearing students on the same campus.

macular degeneration, optic nerve atrophy, diabetic retinopathy, and retinitis pigmentosa (NSPB, 1980a). Early and proper attention to these problems can, in some cases, reduce the degree of impairment and/or prevent further vision loss. However, Barrett's (1979) review of visual assessment services for hearing-impaired persons showed that most programs providing these services are in academic settings. Such services for older hearing-impaired persons are not mentioned in the literature. Because of the high incidence of visual impairments in the aging population, Barrett concludes that visual assessment services for hearing-impaired persons of *all* ages are justified.

Despite the fact that there is a high incidence of visual impairments among hearing-impaired people, it is only during the past decade that programs serving this population have begun to become more aware of: (a) the need to assess the integrity of the visual system, and (b) the need to optimize the use of the visual systems of their clientele (Caccamise, Meath-Lang, & Johnson, 1981; Campbell et al., 1981; Hicks & Pfau, 1979; Johnson et al., 1981; Pimentel, 1980; Stuckless, 1978; Vernon, 1977). Examples of the concerns that have been expressed relative to visual assessment and optimizing the use of vision by hearing-impaired people include:

An area of deafness in which great progress has been made over the last decade has been that of visual screening. To a lesser but significant extent there has been improvement in follow-up services to deaf-visually impaired students. By contrast, in the past more programs educating deaf and hard-of-hearing children gave no eye tests at all or else administered only rudimentary visual acuity measures such as the Snellen Chart. These assessments missed major eye disorders known to be associated with deafness such as Retinitis Pigmentosa, cataracts, glaucoma, and ocular-muscular disorders. (Vernon, 1981, p. 993)

The historic obsession and myopia of exclusive concentration on finding a way to use the weakened sense of hearing represents a formidable barrier to deaf people. Channeling some of this research into ways in which deaf people can better use their other existing normal senses is an idea whose time can no longer be deferred. (Pimentel, 1980, p. 7)

In keeping with the theme of the 1982 Summer Institute of the Academy of Rehabilitative Audiology, the purposes of this paper are to present: (a) the results of previous research conducted at NTID in the area of visual assessment, and (b) trends relative to future needs for optimizing the use of vision by hearing-impaired persons of all ages.

NTID VISUAL ASSESSMENT RESEARCH RESULTS

The issue is that vision represents the key sense remaining in deaf people. Therefore, it must be assessed thoroughly. (Vernon, 1977, p. 4)

In 1976 a Vision Task Force was appointed by the Dean of NTID.² The

²In 1976, Dr. William E. Castle was Dean of NTID. He is currently Vice-President of RIT and

results of a project directed by this task force from July 1976 through December 1979 have been reported by Caccamise, Johnson, Hamilton, Rothblum, & Howard (1980) and Johnson et al. (1981). The topics addressed within these articles include: (a) the importance of visual assessment and research for all persons with hearing loss, (b) background information on the need for an NTID Vision Project, (c) the objectives and expected benefits of the NTID Vision Project, (d) the methodology and results for each objective, (e) recommendations for identification of visual impairments among hearing-impaired persons, (f) recommendations for follow-up after identification of visual impairments (medical, personal/social, and career/academic follow-up), (g) recommendations for further research, and (h) significant audiences for dissemination of information on the importance of vision for hearing-impaired persons.

The article by Johnson et al. (1981) also included the following six appendices: (a) an overview of the anatomy of the human visual system (Appendix A), (b) a list of definitions for visual abilities, pathologies, and assessment instruments/tests (Appendix B), (c) a description of a recommended visual screening program (Appendix C), (d) a vision questionnaire (personal/family ocular history) (Appendix D), (e) a description of recommended on-campus ophthalmological examination procedures (Appendix E), and (f) a summary of comments and recommendations from NTID technical content experts relative to the importance of various visual skills for students enrolled in the academic areas of these professionals (Appendix F).

Caccamise et al. (1981) stressed the significant role of vision in the general development and education of *all* hearing-impaired students. These authors discussed strategies for optimizing the use of vision for communication and learning by hearing-impaired students who *do* and *do not* have visual impairments considering the following factors: (a) environmental parameters (distance, angle, lighting, background, etc.), (b) instructional materials and strategies, (c) use and care of optical visual aids (glasses, contacts, and low-vision aids), and (d) students and parents as resources. In addition, Caccamise et al. (1981) emphasized that cooperative efforts between professionals whose expertise is vision and professionals whose expertise is audition are important if hearing-impaired students are to have the opportunity to optimally use their vision for communication and learning. Since research on appropriate visual assessment procedures has continued at NTID, a summary of this research is provided below.

Previous research at NTID has shown that the Orthorater Vision Tester is a valid and reliable instrument for assessing far and near visual acuity of postsecondary, hearing-impaired students (Johnson et al., 1981). One of the

Director of NTID. As NTID's Director, he continues to support the efforts of NTID personnel involved in visual research and other endeavors designed to develop better methods for assisting NTID students in optimizing their use of vision in academic and career environments.

purposes of subsequent research has been to investigate the use of a rear-illuminated Snellen chart as a less expensive, but equally valid and reliable alternative to the Orthorater for assessing far visual acuity. A comparison of Orthorater and Snellen chart far visual acuity results for 261 students attending NTID in 1981-82 showed comparable false-positive (overreferral) and false-negative (underreferral) rates for these two instruments when a pass-fail referral criterion of 20/40 was used in conjunction with a threshold bracketing technique (psychophysical method of limits); i.e., the Orthorater yielded false-positive and false-negative rates of 7% and 2% respectively and the Snellen false-positive and false-negative rates of 12% and 2% respectively (Johnson & Caccamise, in press). These results indicate that a rear-illuminated Snellen chart is an acceptable, inexpensive alternative to the Orthorater for screening postsecondary, hearing-impaired students' far visual acuity.

Table 1 includes the recommended visual screening assessment instruments, visual parameters for assessment, and ophthalmological referral criteria for postsecondary, hearing-impaired students based on research conducted at NTID (Johnson, et al., 1981; Johnson & Caccamise, in press). For comparison purposes, a battery of assessments/tests recommended by Walters (1978) for visual screening of hearing-impaired persons is shown in Table 2. As indicated in Table 2, at NTID some of these assessments/tests are conducted during the on-campus visual screening program (OCVS) while others are performed by NTID's consulting ophthalmologist if the student is referred for an on-campus ophthalmological examination (OCO). Regardless of the methods used within visual screening programs, it is essential that close collaboration with consulting vision specialists be established to minimize the possibility of visual problems/pathologies going undetected because of failure to perform a particular procedure.³

Although additional research needs to be conducted, it is likely that the visual screening procedures and ophthalmological referral criteria used with the postsecondary NTID students could also be used with secondary-level, hearing-impaired students. However, with younger age groups, other visual assessment procedures and referral criteria may be more appropriate (NSPB, 1972).

Other visual assessment instruments being investigated by the NTID visual assessment program are screening assessments and diagnostic tests for color deficiency and color defectiveness and a diagnostic test for evaluating the integrity of the visual fields of students with diagnosed or suspected progres-

³The incidence rate of retinitis pigmentosa (RP) among persons with hereditary deafness is 3 to 6% (Vernon, 1969). In the early stages of RP the degenerative process usually begins in the periphery of the retina, and this can be ascertained only if the eyes are dilated with cycloplegic drugs which legally may only be administered by an ophthalmologist. It is recommended, therefore, that an ophthalmologist be the vision specialist performing the medical examination for visual screening programs designed for hearing-impaired persons.

Table 1
 Visual Assessment Instruments, Functions Assessed,
 and Referral Criteria for the NTID Visual Screening Program

| Visual Assessment Instruments and Functions Assessed | Recommended | Referral Criteria for an On-Campus Ophthalmological Examination |
|---|-------------|---|
| Orthorater | | |
| Far Acuity | Yes | 20/40 or worse in one or both eyes ^a |
| Near Acuity ^b | Yes | Jaeger 4 or worse in one or both eyes ^a |
| Color Vision | No | |
| Phorias | | |
| Near lateral | No | |
| Far lateral | No | |
| Near vertical | No | |
| Far vertical | No | |
| Stereopsis | No | |
| Snellen Chart (Rear-Illuminated) ^c | | |
| Far Acuity | Yes | 20/40 or worse in one or both eyes |
| Ishihara Color Vision Test | Yes | 7 or more misses on first 13 plates |
| Titmus Stereopsis Tests | No | |
| Vision Questionnaire (Personal/ Family Ocular History) | Yes | Any indication of visual problems |

^aThis information was reported incorrectly in a previous report by Johnson et al. (1981) in Table 6, p. 333. The information in the above table is correct.

^bScreening for near visual acuity is performed on all students 30 years or older.

^cThe translucent Snellen Chart (GS/2867-1261) housed within a G.F. Illuminated Test Cabinet (GF 2867-1258) with stand and weighted base (GF 2867-1259) has been used in recent research conducted at NTID (Johnson & Caccamise, in press) and can now be recommended as an inexpensive alternative to the Orthorater for assessing the far visual acuity of postsecondary-level students. This equipment is available from the Bernell Corporation, South Bend, Indiana.

sive retinopathies such as retinitis pigmentosa. These instruments are discussed in a later section of this paper.

PROBLEMS AND NEEDS OF STUDENTS AND PROFESSIONALS

It is essential to bear in mind that the impairment of deafness and blindness is such that each individual having such a combination is unique in his or her regard. The variables involved in both impairments are quite extensive . . . (Bravin, 1981, p. 707)

This section discusses problems and needs which must be resolved if visually/auditorially-impaired persons are to receive the quality education stipulated for them and other persons with potentially handicapping conditions by the passage of Public Law 94-142 in 1975.⁴ This law stipulates

⁴For a discussion of the terms impairment, disability, and handicap, and the importance of the

Table 2
 Visual Assessments/Tests Recommended by Walters (1978) and their Use
 in the Process for Identifying NTID Students With and Without Visual Impairments

| Recommended Subjective and Objective Assessments/Tests (Walters, 1978) | When Procedure Performed at NTID | Rationale for Performance |
|--|--------------------------------------|--|
| Subjective Assessments | | |
| 1. Case History | OCVS ^a /OCO ^{ab} | Identification of hereditary problems and known or undetected visual problems/pathological conditions. |
| 2. Visual Acuity | | |
| a. Far | OCVS/OCO | Identification of refractive errors, need for correction and presence of pathologies. |
| b. Near | OCVS ^c /OCO | Same as far acuity. |
| 3. Visual Fields | OCO | Identification of retinal deterioration/degeneration such as that which occurs with retinitis pigmentosa |
| 4. Color Vision | OCVS/OCO | Identification of color defects/deficiencies |
| Objective Tests | | |
| 1. Oculomotor Tests | OCO | Identification of normal/abnormal pupillary reflexes and range of eye movement. |
| 2. Ophthalmoscopy | OCO | Determination of the integrity of the retina and other features of the internal, posterior portion of the eye. |
| 3. Retinoscopy | OCO | Estimation of any refractive error of the eye. |
| 4. Tonometry | OCO | Measurement of the internal pressure of the eye for possible presence of glaucoma, etc. |
| 5. Electroretinography (ERG) | OCO ^d | Diagnosis of retinal disease by measuring changes in electrical potential of the retina in response to stimulation with light. Recommended for all congenitally hearing-impaired individuals with hereditary or unknown etiology. |

^aOCVS means On-Campus Visual Screening; OCO means On-Campus Ophthalmological Examination.

^bHoover and Kincaid (1978) described an "ideal examination" for the ophthalmologist's office and Johnson et al. (1981) described recommended procedures for ophthalmological examination on how a person functions, see Caccamise et al. (1980, pp. 93-96) and Johnson et al. (1981, pp. 345-348).

tions with hearing-impaired persons.

^cNear visual acuity assessments are performed during the OCVS for all students 30 years of age or older.

^dERGs are performed on NTID students upon recommendation of the consulting ophthalmologist and are considered an extension of the OCO.

that all handicapped children should have available to them a free *appropriate* public education which emphasizes special education and related services designed to meet their *unique needs*. In addition, this education should take place in the least restrictive environment for *each* student; i.e., that environment which provides each student with the best possible education (DuBow, 1977).

Although the problems and needs discussed within this section deal primarily with visually/auditorially-impaired students at the postsecondary level, there are implications for students and clients at all grade/age levels. Topics discussed include: (a) problems in terminology as they relate to admission criteria for academic programs, (b) problems of program availability for students with both visual and auditory impairments, (c) the need to provide a broader variety of professionals who are properly trained in identification and follow-up procedures with hearing-impaired students having visual impairments, (d) the need to provide *all* hearing-impaired students information about visual hygiene and optimal use of their vision, and (e) the need for continuing research in the areas of visual assessment and follow-up procedures for hearing-impaired persons with and without visual impairments. This list of problems is not intended to be all-inclusive, but merely indicative of the current "state of the art" relative to visually/auditorially-impaired persons. However, until these and other problems/needs are appropriately dealt with, it is not likely that these students will receive the quality of education stipulated by P.L. 94-142.

The Problem of Terminology and Educational Placement

Visual and audiological terminology have posed a major problem in relation to educational placement for visually/auditorially-impaired students. Some programs restrict their educational services to only those students who are classified as legally blind, while others provide these services to visually-impaired people as well (Hatfield, 1975).^{5,6} With respect to programs for the

⁵The *legally blind* are those persons whose central visual acuity does not exceed 20/200 in the better eye with corrective lenses and/or whose fields of vision are so limited that the widest diameter of visual field subtends an angle no greater than 20°. This definition includes *severe vision impairment* and *medical blindness* (the inability to perceive light), and is used by most states and the federal government for legal purposes such as aid to the blind, income tax exemption, and special educational materials (NSPB, 1981).

⁶The *visually impaired* are those persons with some degree of visual impairment in one or both eyes, but are not legally blind. Many of these persons are in the severe vision impairment

deaf-blind, the Helen Keller National Center for Deaf-Blind Youths and Adults generally limits its comprehensive evaluation and rehabilitation training program to persons who are legally blind although there are some exceptions; i.e., exceptions may be made for deaf-blind individuals with visual or auditory conditions who show poor prognosis, or for those whose ability to use their vision and/or hearing is so limited as a result of protracted inadequate use of either or both of these senses that they function as deaf-blind persons (Kramer, Sullivan, & Hirsch, 1979).

These same problematic conditions relative to criteria for program admission exist in programs for hearing-impaired people. For example, Gallaudet College and NTID both require that applicants have a 70 dB or greater hearing loss in the better ear (ANSI, 1969). Other postsecondary programs listed in *A Guide to College/Career Programs for Deaf Students* (Rawlings, Trybus, & Biser, 1981) include among their admission criteria: (a) student must have an educationally significant hearing loss, (b) student must be in need of support services, (c) student audiograms are required and evaluated with deaf-blind students also admitted, and/or (d) there are no requirements for admission except hearing loss. None of the postsecondary programs listed in Rawlings et al. are specific concerning the severity of visual-impairment requirements or support services available for students with visual impairments.

Unless functional descriptions are provided, terms such as legally blind, severe visual impairment, and educationally significant hearing loss as criteria for admission to an educational program do not adequately allow for the unique needs of the individual student. As Bravin (1981) and Kramer et al. (1979) stressed, students with both visual and auditory impairments are so unique in their needs for educational support services that program placement must be based on the results of an assessment/test battery. Once the levels and types of support required for a visually/auditorially-impaired individual to be successful within an educational environment have been determined, it then becomes more possible to identify those programs which will most closely meet *that* student's academic/career, personal/social, and communication needs.⁷

Because a more functional approach to student educational placement often has not been followed, many visually/auditorially-impaired students have been inappropriately placed in programs for the deaf (Hicks & Pfau, 1979), programs for the blind (Hatfield, 1975), and programs for the deaf-

category in that they cannot read ordinary newsprint even with the aid of glasses, but have vision better than 20/200 (NSPB, 1981).

⁷One example of a problem of using the term legally blind as a criterion for entrance to an educational program is that some persons with visual fields limited to 20° may still have intact central vision which might allow them to function appropriately in an academic environment designed for deaf persons with only minor personal/environmental modifications (secondary visual impairment).

blind (Kramer et al., 1979). Too often these programs have not provided these special students the types and levels of support services necessary to their academic success.

In order to assist in preventing problems of inappropriate educational placement, NTID recently implemented an admissions policy for hearing-impaired applicants with known or suspected visual problems. This policy is based on functional definitions for *primary and secondary visual impairments*. A primary visual impairment is one which requires that *extraordinary support services* be provided in order for the student to be successful within the NTID academic environment.⁸ A student with a secondary visual impairment would only require minor personal and/or environmental modifications over and above those support services normally provided for NTID's population in order to be academically successful.⁹

According to NTID policy, applicants with known or suspected primary visual impairments are requested to visit NTID prior to admission. During this visit they receive formal and informal evaluations designed to determine their potential for academic success without extraordinary visual support services (primary hearing impairment and/or non-existent or secondary visual impairment). Formal evaluations include an on-campus ophthalmological examination (when deemed necessary) and a battery of screening devices to elicit information concerning receptive and expressive communication skill levels (Johnson & Caccamise, 1981). Informal evaluations are designed to elicit information concerning the student's ability to function within the social and academic (technical) environments at NTID in particular and RIT in general. They are coordinated by NTID's Vision Specialist. Upon conclusion of the evaluation process, the NTID Admission Review Board determines the appropriateness of admitting the applicant, and this decision is shared with the applicant and her/his parents, legal guardian and others as appropriate.

If the decision is *not to admit* (primary visual impairment), the NTID Vision Specialist presents alternatives to the applicant and makes referrals regarding career development. If the decision is *to admit conditionally* (secondary visual impairment), the Vision Specialist reconvenes the Review Board to develop a learning contract.¹⁰ The learning contract is monitored

⁸Examples of extraordinary support services often required by students with severe visual impairments are companions or mobility instructors, tactile interpreters, Braille materials, typed classroom notes, and large typing fonts and enlarged images.

⁹Students are admitted to NTID because they have primary (rather than secondary) hearing impairments and require a variety of extraordinary support services normally provided for students with severe or profound hearing losses in order to be academically successful. The 12 support services provided by NTID are listed in *A Guide to College/Career Programs for Deaf Students* (Rawlings et al., 1981).

¹⁰A learning contract is similar to an Individualized Education Program (IEP). P.L. 94-142 requires that IEP's be designed for all handicapped students in educational programs receiving

by administrative personnel in each student's career major. A similar process is followed for students who have registered for the five-week Summer career sampling program prior to NTID's knowledge of an existing primary or secondary, correctable or non-correctable visual impairment. However, in this case, the process begins with a visual screening program administered during the first week of the Summer program.¹¹

The purpose of NTID's vision policy is not to deny admission to applicants who are both visually and auditorially-impaired, but to help ensure that *all* hearing-impaired students receive their postsecondary education in an environment which is most conducive to their success. If other programs at all grade levels were to develop and apply similar functional criteria for admission of visually/auditorially-impaired applicants, it is more likely that these students would truly receive their education in "the least restrictive environment" as specified by P.L. 94-142.

Non-Availability of Academic Programs for Students with Visual and Auditory Impairments

Prior to 1970 there were probably fewer than a dozen programs in the United States specifically designed for deaf-blind children, although there has been a dramatic increase in the number of programs available for these children during the past ten years. Moreover, the number of hearing-impaired students in residential schools for the deaf reported as having severe visual problems has doubled nationwide (Bishop, 1981).

The problem of program availability for visually/auditorially-impaired students is true at the postsecondary level as well as at lower educational levels. Hicks and Pfau (1979) reported that 49 of 55 postsecondary programs serving deaf students in the United States responded to a comprehensive telephone survey in 1978. Twenty-two of these programs stated they were serving a total of 82 deaf students with visual impairments. Among these 22 programs, there were 7 colleges, 4 community colleges, 4 universities, and 7 vocational technical schools. Although no information was reported concerning severity of visual impairments for the students being served, the types of support services provided included interpreting (16 programs), note-taking (9 programs), mobility training (5 programs), special equipment including reading machines, magnifiers, enlarged print, and Brailled materials (13 programs), tutoring (15 programs), and counseling (12 programs). Thus, the level of support services provided varied among the programs as did, more than likely, the severity of the visual and auditory impairments.

financial and other support from the federal government.

¹¹For more detailed information concerning the NTID vision policy, contact the Director of the NTID Division of Career Opportunities, One Lomb Memorial Drive, P.O. Box 9887, Rochester, New York 14623. Ask for a copy of *Policies and Procedures Concerning Prospective and Registered NTID Students with Primary and Secondary Visual Impairments*.

Although Hicks and Pfau (1979) reported 22 programs serving visually/ auditorially-impaired students, the Reference Issue of the *American Annals of the Deaf* lists only a single college; i.e., Ohlone College, Fremont, California (Craig & Craig, 1982). However, recent discussion with the Project Director of the Ohlone College Deaf-Blind Program disclosed that this program has lost its federal funding and is being forced to close. If there are other programs at the postsecondary level serving visually/auditorially-impaired students as indicated by Hicks and Pfau (1979), there needs to be a publication similar to *A Guide to College/Career Programs for Deaf Students* (Rawlings et al., 1981) to help make these programs better known. This new guide, in addition to the information in the guide for deaf students, should include types and levels of support services available to visually/ auditorially-impaired students in order to assist in appropriate educational program placement for these students.

Hicks and Pfau (1979) also reported that surveys conducted in 1974 by the National Center for Deaf-Blind Youths and Adults and Single State and Multi-State Centers for Deaf-Blind Children have located about 5,000 deaf-blind adults and 5,064 deaf-blind children in the 50 U.S. states, Puerto Rico, the Virgin Islands, the Trust Territories, and Guam. These visually/ auditorially-impaired children and adults deserve the type of quality special education and services designed to meet their unique needs as stipulated by P.L. 94-142. However, it does not appear that enough qualified educational programs are currently available. If they are available, the appropriate vehicle to make their availability known needs to be developed as stated above. Further, given the needs of persons with both visual and auditory impairments, a few well-planned, supported, postsecondary regional educational programs are preferable to a large number of programs with inadequate environmental planning and staff (Johnson et al., 1981).

Needs of Professionals Working with Visually/Auditorially-Impaired Students

The high incidence of visual impairments among hearing-impaired persons makes it imperative that persons working with hearing-impaired students be informed and trained in various aspects of visual impairment, including visual assessment and follow-up procedures.

Walters (1978) and the NSPB (1980b) suggested that it is not only feasible, but even highly desirable to train volunteers and individuals working in educational programs to carry out visual assessment procedures. Hicks and Pfau (1979) stated that personnel in schools for the deaf need a better understanding of the characteristics and progressive nature of particular visual defects and an updated awareness of different referral agencies which can provide student services. Eisenberg (1963) suggested that audiologists and speech pathologists working with children be trained to recognize and

deal appropriately with visual perceptual problems. Vernon (1981) recommended the training of more rehabilitation and educational specialists to serve deaf-blind adults.

NTID, partially in response to the above needs, has developed a course (*Assessment and Use of Vision Among Hearing-Impaired Students*) for persons currently working or preparing to work with hearing-impaired students. The goals of this course are: (a) to provide a perspective on the importance of vision to the development and learning of *all* hearing-impaired students, (b) to provide a description of the anatomy and physiology of the visual system, (c) to describe visual pathologies and functional visual problems and their incidence and implications among/for hearing-impaired students, (d) to discuss recommended assessment (visual screening) and examination (ophthalmological) methods for identifying hearing-impaired students who do and do not have visual problems, (e) to assist course participants in developing the knowledge and skills needed to develop, manage, and conduct visual screening programs, (f) to discuss medical, academic/career, personal/social, and communication follow-up for all students having visual problems, (g) to describe strategies for optimizing the use of vision for communication and learning by *all* hearing-impaired students, and (h) to discuss resources that provide support for identifying visual problems and follow-up services. Practicum in visual screening of postsecondary hearing-impaired students is provided during the second week of this two-week course.

This course was originally designed for graduate students enrolled in the joint NTID/University of Rochester Educational Specialist Program for the Deaf which prepares its students to work with deaf students at the secondary level. As a result of its success, the course is now being offered each summer to students and professionals on a nationwide basis.¹²

Because audiologists, speech-language pathologists, and deaf educators all work on strengthening/developing communication skills of hearing-impaired students, it is important that they be aware of the integrity of the visual systems of their hearing-impaired students/clients before initiating therapeutic procedures. Thus, it is recommended that information on vision and the visual system be a part of the curriculum offered in programs training these professionals. In addition, a series of workshops in visual assessment and follow-up procedures should be offered to other professionals working with hearing-impaired persons. Finally, personnel in programs serving hearing-impaired students/clients, in cooperation with vision specialists, should provide in-service training to assist other staff members in: (a) learning the

¹²For additional information concerning application procedures for the Summer course, *Assessment and Use of Vision Among Hearing-Impaired Students*, contact the Director of the Educational Specialist Program for the Deaf, Graduate School of Education and Human Development, University of Rochester, Rochester, New York, 14627.

signs and symptoms of visual impairments, (b) learning about visual hygiene, and (c) learning to work with *all* students/clients in order to help optimize the use of their vision.

Student Needs Relative to Visual Hygiene and Optimal Use of Vision

Depending upon the deaf-visually impaired child's age and severity of visual disability, a comprehensive program might include such things as: vision health care, orientation training, mobility and prevocational training, evaluation, typing, Braille, physical conditioning, and counseling. As a result of such individualized activities, the students should learn the skills necessary to begin to function adequately with limited sight. (Hicks & Pfau, 1979, p. 83)

In addition to Hicks and Pfau (1979), several other authors have emphasized the need to instruct all students in good visual hygiene, safeguarding vision, and optimizing the use of vision (Caccamise et al., 1980; Caccamise et al., 1981; Johnson et al., 1981; NSPB, 1972; Schein, 1977). This instruction is especially imperative for hearing-impaired students for whom good vision becomes paramount for learning, mobility, recreation, social interaction, and vocational pursuit (Barrett, 1979).

The NSPB (1972) has developed model curricula in vision for students from preschool through 9th grade. Most entering NTID students know little about visual hygiene and optimizing the use of vision. Thus, such information has been proposed for inclusion within one of the required NTID human development courses. The early adolescent NSPB curriculum could be adapted for use with hearing-impaired students at the secondary and post-secondary levels by adding those components dealing with environmental parameters, instructional materials and strategies, and use and care of optical visual aids suggested by Caccamise et al. (1981).

In conclusion, it is recommended that *all* programs providing instruction for hearing-impaired students include curricular components dealing with visual assessment, optimizing the use of vision, and visual hygiene. Early and continuous counseling and training should be provided for those hearing-impaired students whose progressive types of visual impairments will eventually result in blindness (legal or medical), and persons working and preparing to work with hearing-impaired students should become informed on how to help meet the visual needs of *all* hearing-impaired students.

Research Needs

Visual Assessments/Examinations. As previously stated, research on identification of appropriate visual assessment procedures and referral criteria for an ophthalmological examination has been ongoing at NTID since 1977. Visual assessment projects currently underway at NTID include one concerned with color vision and another with retinitis pigmentosa and progressive retinal degeneration. It is hoped that successful completion of

these projects will lead to improved academic/career and personal/social counseling of NTID students.

Color Vision. Since 1977 NTID has been screening its entering student population for color vision problems. The results of research concerned with identification of an appropriate color vision screening instrument were reported by Johnson et al. (1981). The Ishihara Test for Color Vision was found to elicit the lowest false-positive (overreferral) and false-negative (underreferral) rates for ophthalmological referral. Thus, it was recommended for use at NTID and in other postsecondary programs serving hearing-impaired students. The current referral criterion for an ophthalmological examination using the Ishihara as the screening instrument is failure to identify the numbers on 7 or more of the first 13 plates (see Table 1). Using this referral criterion, it is projected that approximately 11 entering NTID students will fail the Ishihara color vision screening each year.

One additional diagnostic test (The Farnsworth-Munsell 100-Hue Test for the Examination of Color Discrimination) and one additional screening instrument (The Farnsworth Dichotomous Test for Color Blindness — Panel D-15) have recently been added to the color vision battery in response to requests for additional visual information about students from faculty members in career areas requiring fine color discrimination (color photo processing and graphic arts). NTID's present research on color vision is designed to respond to several questions: (a) Is the current Ishihara criterion for ophthalmological referral appropriate?; (b) Can students be provided improved counseling as to whether they are color deficient or color defective?¹³; (c) Can students be provided improved counseling as to which color confusions they can expect to make?; (d) Will this information be helpful to NTID students in the career selection process?; (e) Can students with color deficiency or defectiveness be successful in careers which require fine color discrimination?; and (f) Can instructors in career areas which require fine color discrimination utilize the above information to modify the environment in ways that will assist students with color deficiency or defectiveness to be successful in these career areas?

¹³*Color defective vision* is most often caused by the absence of either the green, red, or blue pigments in the cones of the retina of the eye (or less often, two or more of these pigments). Without all three pigments, the person is unable to see some colors, and thus, some colors appear the same and the person makes color confusions. It is sex-linked and probably results from the absence of appropriate color genes in the X chromosome. It is a recessive trait and women are the carriers. In the general population, it occurs in approximately 1 out of every 10 males and 1 out of every 200 females. It does not change in type or degree with age, has no relation to other visual defects, and there is no known cure or remedy. Persons may have color discrimination problems that are mild, moderate, or severe. *Color deficient vision* herein is differentiated from color defectiveness in that all three color pigments are present in the cones of the retina, but there is a deficiency of one or more of these pigments due to faulty development or some ocular pathology. It is not inherited and there is no known remedy. These persons may also experience problems with fine color discrimination which may be mild, moderate, or severe.

Visual fields. Since 1977, 25 students entering NTID have been identified as having Retinitis Pigmentosa (RP). It is suspected that most, if not all, of these students have Usher's Syndrome, a disease involving a severe to profound hereditary hearing loss and a progressive loss of vision due to retinal deterioration usually beginning in the periphery of the retina and gradually progressing centrally. Usher's Syndrome can vary greatly in age of onset, severity, and speed of progression. The symptoms of Usher's Syndrome are: (a) night blindness (poor dark adaptation) which is usually present to some extent from childhood, but usually does not bring the patient to the doctor; (b) poor peripheral vision (visual field loss) which is usually detectable by the teens, but frequently the patient is unaware of the problem until it is fairly advanced; and (c) poor central vision which is usually not a major problem until later in life (around the early or mid-forties or later); however, exceptional cases occur earlier. Moreover, loss of side vision makes central vision less useful than normal even when central vision is normal (Bergsma, 1973).

Persons with Usher's Syndrome need to be informed about the progress of the disease process since it has profound implications for career planning, personal/social counseling, and other training for eventual blindness. NTID has a Marco Projection Perimeter which has the capability of graphically plotting the progression of visual field reduction that results from retinal deterioration. Longitudinal research with NTID students having Usher's Syndrome is needed to demonstrate the efficacy of using the projection perimeter to plot the progression of visual field reduction due to retinal degeneration. Periodic assessment with this instrument could yield information useful for counseling students as to the status of their visual impairment and for learning more about the rate at which retinal deterioration in persons with Usher's Syndrome takes place.

Other Assessment Needs. Further assessment research needs include investigations to identify: (a) appropriate visual screening approaches with preschool through secondary-level, hearing-impaired students, (b) research for identification of retinitis pigmentosa (i.e., investigation of possible screening instruments for assessing temporal processing of visual stimuli and dark adapted visual sensitivity) (Johnson et al., 1981) and (c) acceptable, less expensive alternatives to the Orthorater for near visual acuity screening of hearing-impaired students (preschool through postsecondary levels). One alternative for the latter is the *Plus Lens Test for Hyperopia* which can be administered using a rear-illuminated Snellen chart (Lippman, 1962; NSPB, 1972). Based on additional literature review and consultation with vision specialists, further research on near acuity assessment approaches will be considered at NTID.

Demographic Information Studies. Hicks and Pfau (1979), the NSPB (1980a), Schwartz and Vernon (1974), and Bishop (1981) and many others

have alluded to the need for better incidence and other demographic information on hearing-impaired persons with visual impairments. In addition to the need to determine the actual numbers of visually/auditorially-impaired persons and their locations, there is a need to determine: (a) the severity of both their visual and hearing impairments, (b) the types and kinds of services which they are receiving, and (c) the kinds and appropriateness of their educational placements. Because this information is not accessible in a centralized agency at the federal level, deaf-blind people too often "fall between the cracks" (Vernon, 1981).

Optimizing the Use of Vision. Research needs related to optimizing the use of vision include: (a) research to determine physical characteristics — lighting level and sources, colors, dimensions — of a classroom optimally suited to instructing deaf students (Schein, 1977), and (b) research to determine which types and levels of visual impairments may cause problems in specific academic and career environments (Johnson et al., 1981).

SUMMARY AND CONCLUSIONS

Given the importance of vision to hearing-impaired people, early identification and treatment of their visual problems is essential. In addition, information about visual hygiene is important to hearing-impaired people if unnecessary visual problems are to be prevented.

Hearing-impaired students/clients with permanent visual impairments require academic/career training programs that take into account their special needs. This requires the cooperative efforts of professionals whose expertise is audition and professionals whose expertise is vision. Such cooperation will hopefully result in an increased number of professionals who possess the knowledge and skills needed to assist *all* hearing-impaired students/clients to optimize their use of *vision and audition*.

Research needs include: (a) investigations designed to improve techniques for identifying hearing-impaired people who do and do not have visual impairments, and (b) investigations designed to gain information needed to provide optimal academic/career, personal/social, communication planning, educational placement, and special services for *all* hearing-impaired persons.

The major benefit of accomplishing the above will be an increased probability that each hearing-impaired student/client will have the opportunity to learn and develop in the *least restrictive environment for her/him*.

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