Deaf and Hard-of-Hearing Students in Transition:

Demographics with an Emphasis on STEM Education

Gerard G. Walter

Project Consultant for
Testing the Concept of a Virtual Alliance for Deaf
and Hard-of-Hearing STEM Students at the Postsecondary Level
NSF HRD-0927586
and
Planning Grant for the Center for
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NSF DUE-0903167

National Technical Institute for the Deaf
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June 1, 2010

This project is supported by the National Science Foundation
under Award Numbers HRD-0927586 and DUE-0903167.
Any opinions, findings, and conclusions or recommendations expressed in this report are
those of the author and do not necessarily reflect the views of the National Science Foundation.

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Executive Summary

This paper will provide an overview of the educational and occupational status of students who are deaf or hard of hearing as they move from high school to college and into the world of work. Specific emphasis is given to students in science, technology, engineering and mathematics (STEM) majors in college and STEM occupations of adult workers. The paper provides documentation to support funding of programs to improve the likelihood of these students entering and completing postsecondary education.

The paper incorporates data and information from a number of primary sources in addition to referencing studies from the literature. Major primary sources of data include: U.S. Office of Special Education Program's Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act (IDEA), 2007; National Longitudinal Transition Study-2 (NLTS2); National Postsecondary Student Aid Study, 2008 (NPSAS:08); Beginning Postsecondary Students Longitudinal Study, 1996/01 (BPS:96/01); and the American Community Survey (ACS), 2008.

Results from achievement testing indicate that the majority of high school students who are deaf or hard of hearing with IEP's read at the fourth grade level or lower. In addition, students who are deaf or hard of hearing take fewer advanced mathematics courses in high school than do their hearing peers. This overall lower achievement may explain why more students who are deaf or hard of hearing enroll in two-year colleges than do hearing high school graduates.

Approximately 60 percent of high school graduates who are deaf or hard of hearing attend some form of postsecondary education. The National Postsecondary Student Aid Study reports 136,000 postsecondary students who indicated they were deaf or hard of hearing in the 2007-2008 academic year. Fifty seven percent of these students attended two-year or less than two-year schools. This compares to 48 percent for hearing students. One reason for this difference could be the lower achievement of students who are deaf or hard of hearing. Only one third were pursuing a bachelor's degree compared to 47 percent of hearing students.

Graduation from college results in major economic benefits for persons who are deaf or hard of hearing when compared with their peers who do not have a college degree. In

2007, college graduates earned, 2.3 times more than non-college graduates: $40,522 compared to $17,448 for non-graduates. The higher the postsecondary degree achieved by persons who are deaf or hard of hearing, the lower their unemployment rates, and the more like the rates reported for hearing persons. Deaf or hard- of-hearing workers employed in STEM occupations earn 31 percent more than those employed in other occupations.

Introduction

The second half of the 20th century has been one of the most active periods in the history of postsecondary education in the United States. During this time, postsecondary education has, without question, been a "growth industry." The initial impetus resulted from federal legislation that enabled large numbers of World War II veterans to attend colleges and universities. Subsequently, the sons and daughters of these same veterans began entering postsecondary institutions in large numbers during the 1960's and early 1970's, prompting massive expansion in staffing, facilities, and curricula. Fueled by demand for higher education, community colleges expanded, opening the doors of postsecondary education to large numbers of individuals who otherwise would not have had access to traditional higher education.

Growth during this same period also was fueled by societal changes in attitudes regarding college attendance. Driven by the launching of Sputnik, the goal to put a man on the moon, and the civil rights movement, societal goals for education at the collegiate level focused on issues of access to and training in the technologies. Technological advancements following World War II, preparedness during the Cold War, and the race to put a man on the moon, resulted in the demand for highly trained specialists in science, technology, engineering and mathematics (STEM). The demand for skills in these areas has resulted, by the beginning of the 21st century, in increased emphasis on more education by the general population.

Access to postsecondary education and choice of school by individuals initially centered on the issue of college opportunities for children from low-income families, but extended to disabled individuals with the passage, in 1973, of Section 504 of the Vocational Rehabilitation Act.

> *No otherwise qualified handicapped individual in the United States…Shall, solely by reason of his handicap, be excluded from the participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal assistance. (Public Law 93-112: Section 504)*

This provision was extended by passage of the Americans with Disabilities Act of 1990.

> *No qualified individual with a disability shall, by reason of such disability, be excluded from participation in or be denied the benefits of the services, programs, or activities of a*

public entity, or be subjected to discrimination by any such entity. (American with Disabilities Act of 1990, Section 202)

State and federal efforts in support of these acts have taken a variety of forms, including financial support for the elaborate network of community colleges and expanded state university systems. In addition, increased financial aid to students has improved access, while contributing to the ability to choose one's school.

The door to postsecondary education has been opened for deaf and hard-of-hearing persons in the United States. What impact has this access to higher education had on the lives of those who choose to attend college? This historical perspective sets the stage for the key topics discussed in this paper, namely, educational attainments, employment, occupation, and earnings of deaf and hard-of-hearing persons in the United States, and, more specifically, the impact postsecondary education has on improving the economic status of persons who are deaf or hard of hearing and graduating with a college degree, especially in STEM majors.

Methodology

It has been nearly 40 years since Schein and Delk (1974) published the results of a national census of the deaf population in the United States. Since that time, there have been no comprehensive studies of persons who are deaf or hard of hearing. However, data are available from a number of recent surveys that, taken together, can provide insight into the contemporary demographic and economic status of this group of citizens. The objective of this monograph is to provide an overview of information about students who are deaf or hard of hearing as they move from high school to college and beyond into the world of work. Specific emphasis will be given to students in science, technology, engineering and mathematics (STEM) majors in college and STEM occupations of adult workers.

This paper will use data and information available from a number of primary sources, in addition to referencing studies from the literature. The major primary sources of data include:

- U.S. Office of Special Education Program's (OSEP) Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act (IDEA), 2007, http://www2.ed.gov/about/reports/annual/osep/index.html.

- National Longitudinal Transition Study-2 (NLTS2), http://www.nlts2.org/.

- National Center for Education Statistics (NCES), National Postsecondary Student Aid Study, 2008 (NPSAS:08), http://nces.ed.gov/surveys/npsas/.

- NCES, Beginning Postsecondary Students Longitudinal Study, 1996/01 (BPS:96/01),. http://nces.ed.gov/surveys/bps/.

- U.S, Census Bureau, American Community Survey (ACS), 2008, http://www.census.gov/acs/www/.

With the exception of OSEP's Annual Report to Congress, the other sources provide tools for the researcher to select data and conduct analyses online through various cloud computing applications. The National Center for Education Statistics (NCES) provides access through the Data Analysis System (NCES, 2010), and the U.S. Census Bureau through the Data Ferret (U.S. Census Bureau, 2010). Access to the NLTS2 is available through a restricted data set and through its online Table Analysis System. All analyses were conducted using one of these systems.

A Question of Definition

Severity of hearing loss is an important consideration when defining who to include in the population of persons who are deaf or hard of hearing. In the 1970's, the term "hearing impaired" was used as a generic label for people who were both deaf or hard of hearing. Unfortunately, this label obscures differences that may exist vis-a-vis communication abilities, educational attainments, social relationships, and cultural identity. Today the term "persons who are deaf or hard of hearing" is generally used to describe the population of individuals with some kind of hearing impairment. This terminology will be used throughout this paper. For a detailed discussion of the definition of the population of persons with hearing loss, see Mitchell (2006).

When describing the severity of hearing impairment, it is important to distinguish whether one or both ears are affected, and the degree of loss in each. A commonly used

classification of hearing loss in terms of decibel[1] (dB) loss includes mild (21-40 dB), moderate (41-60 dB), moderate-severe (61-70dB), severe (71-90dB) and profound (91+ dB), with each category representing decreasing auditory sensitivity. The category into which an individual is grouped depends on his or her pure tone average (PTA), or the average threshold levels (in decibels) measured at 500, 1000, and 2000 hertz[2] (Hz).

Unfortunately, it is not generally feasible to conduct in-depth audiological evaluations in connection with national surveys. The surveys referenced above (except for the Annual Report to Congress and the NLTS2) rely on self-reported information about hearing loss. For example, the National Postsecondary Student Aid Study and the Beginning Postsecondary Students Longitudinal Study ask, "What is the main type of condition or impairment you have?" The respondent selects from a list where one choice is "Hearing impairment (i.e., deaf or hard of hearing)." The American Community Survey asks, "Is this person deaf or does he/she have serious difficulty hearing?" The response is "Yes or No." The Annual Report to Congress on the implementation of IDEA and the NLTS2 included school-aged children who had an Individual Education Plan (IEP) where the main condition was hearing impairment. Typically, the IEP requires regular audiological assessments. As a result, classification of individuals with a hearing loss will vary with each data set. As the findings from these surveys are presented, the reader must bear in mind the differences in definition about the level of hearing loss.

How many deaf people are there in the U.S?

In order to provide a foundation for the later discussions about education and work, it is appropriate to review information about the number of persons who are deaf or hard of hearing in the U.S. population.

The American Community Survey (ACS) is a nationwide survey of population and housing information, conducted annually by the U.S. Bureau of the Census, that offers communities a fresh look at how they are changing. The 2008 ACS asked whether a person is deaf or has serious difficulty hearing, thus permitting estimation of the number of persons who are deaf or hard of hearing. The results (Table 1) show that, in

[1] A unit for expressing the relative intensity of sounds on a scale from zero for the average least perceptible sound to about 130 for the average pain level.
[2] A unit of frequency equal to one cycle per second.

round numbers, about four percent of the US population has some difficulty hearing, with the majority of these individuals being 65 years of age or older. On the other end of the age spectrum, less than one percent of school age children are deaf or hard of hearing. These estimates are very similar to the 11,000,000 people in the United States over 5 years of age who are deaf or hard of hearing reported by Mitchell (2006), who used the Survey of Income and Program Participation (SIPP) to make his estimates. It is probably safe to say that the numbers reported from the ACS and the SIPP include, for the most part, individuals from the same population of deaf and hard-of-hearing persons.

Table 1. Numbers of persons reported having difficulty hearing in the US population: American Community Survey, 2008.

		Difficulty hearing	
Age Group	US Population[1]	%[2]	#
<18	73,890,630	0.63%	464,173
18-44	113,224,824	1.17%	1,330,055
45-64	78,147,357	3.69%	2,886,403
65+	38,796,917	16.29%	6,318,905
Total	304,059,728	3.62%	10,999,536

Source: 2008 ACS Public use data sample. Table constructed using Data Ferret.

Analysis of data from both the SIPP and the ACS reveal a substantial increase in the incidence of deafness beyond the age of 45, and a dramatic increase among people 65 years of age and older. Also, the handicapping effects of losses for the elderly will be substantially different from those of the young adults—the focus of this monograph.

Preparation for Postsecondary Education

Number of school-age children

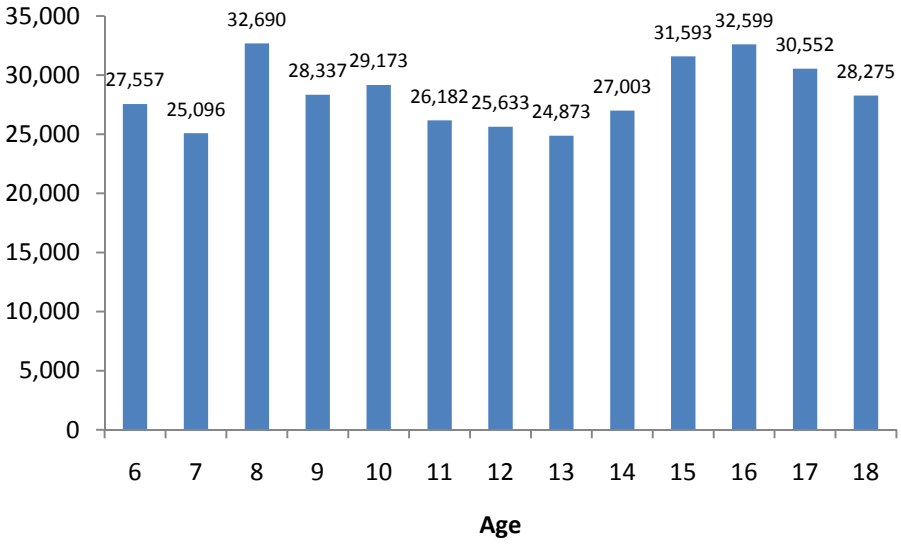
This section focuses on school-age children with emphasis on those who are in transition from school to work or postsecondary education. As a starting point, one must ask how many children who are deaf or hard of hearing are enrolled in the K

through 12 education system? As with determining the population of individuals who are deaf or hard of hearing, describing how many children there are depends upon who is counted as being deaf or hard of hearing. The data sources used in this paper result in two different counts.

The ACS estimates, that there are 341,288 children between ages 6 and 18, who have difficulty hearing (Figure 1). In contrast, the *Annual Report to Congress on Implementation of IDEA*: 2007, reported by the U.S. Department of Education's Office of Special Education Programs, counted only an average of 5,400 students at each age who had IEPs where the major disability was hearing loss (Figure 2). Based on OSEP's count, just over 67,303 children between 6 and 18 who are deaf or hard of hearing were receiving instruction under IDEA in 2007 (*Annual Report to Congress, 2007*).

Figure 1. Students in the US between ages 6 and 18 who have difficulty hearing.
American Community

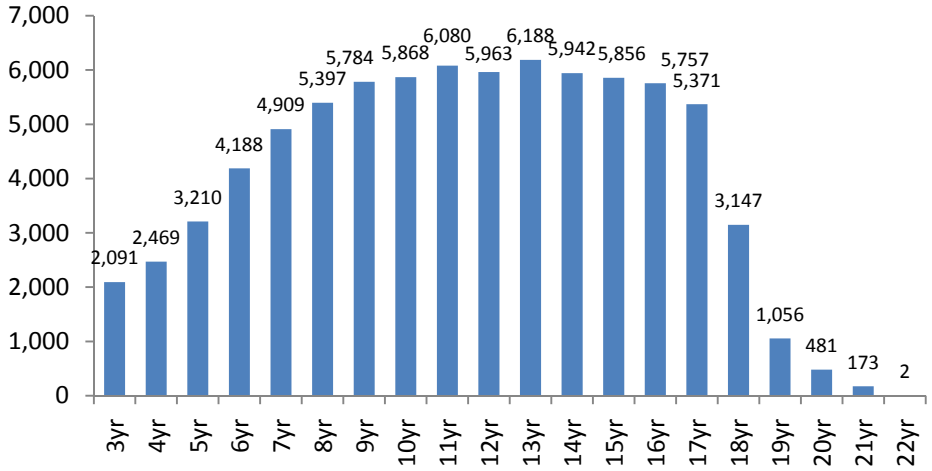
Survey: 2008.



Source: 2008 ACS public use data sample. Calculations made using Data Ferret.

The disparity between the ACE numbers and those from the OSEP child count indicates that probably a significant number of young people in schools have hearing losses that do not reach a threshold sufficient to make them eligible for needing an IEP.

Figure 2. Students who are deaf or hard of hearing served under IDEA, Part B, by age: Fall 2007.



Source: Office of Special Education Programs Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act (IDEA): 2007, Data Accountability Center, Table 1-7, https://www.ideadata.org/arc_toc9.asp

This disparity is supported by Mitchell (2006) who reports 279,630 children, ages 6 to18, who have at least some difficulty hearing normal conversation. Suffice it to say that there are approximately 300,000 school age children between 6 and 18 in the United States who have significant hearing losses. The question must be raised as to how individuals with a hearing loss who have not been identified as needing an IEP perform academically, whether they have been misdiagnosed as having another disabling condition, or have just gone unnoticed.

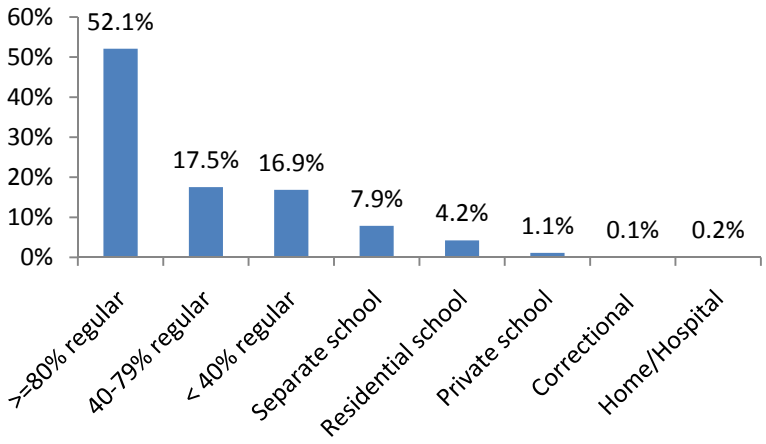
According to the Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act (IDEA): 2007, nationally, 86 percent of students who are deaf or hard of hearing with IEP's are being educated in mainstreamed classes, with 52 percent of them spending 80 percent or more of their time in regular classes (Figure 3).

A great deal is known about the students who have IEPs. This information comes from the National Transition Longitudinal Study - 2 (NLTS2). The NLTS2 is funded by the U.S. Department of Education and is documenting the experiences of a national sample of disabled students who were 13 to 16 years of age in 2000 as they move from secondary school into adult roles. The study focuses on a wide range of important

topics, such as high school coursework, extracurricular activities, academic performance, postsecondary education and training, employment, independent living, and community participation. In addition to other disabilities, the NLTS2 database represents a rich source of information about the performance of students with IEP's who are deaf or hard of hearing. Special emphasis is given to collecting data about students in transition.

The NLTS2 statistics are weighted estimates of the national population of students who are deaf or hard of hearing receiving special education in the NLTS2 age group. The response for each sample member is weighted to represent the number of youth nationally that are in his or her disability category in the kind of school district (defined by region, student enrollment, and proportion of students in poverty) or special school from which he or she was selected.

Figure 3. Percentage of students who are deaf or hard of hearing served in various educational environments ages 6 through 21: Fall 2007.



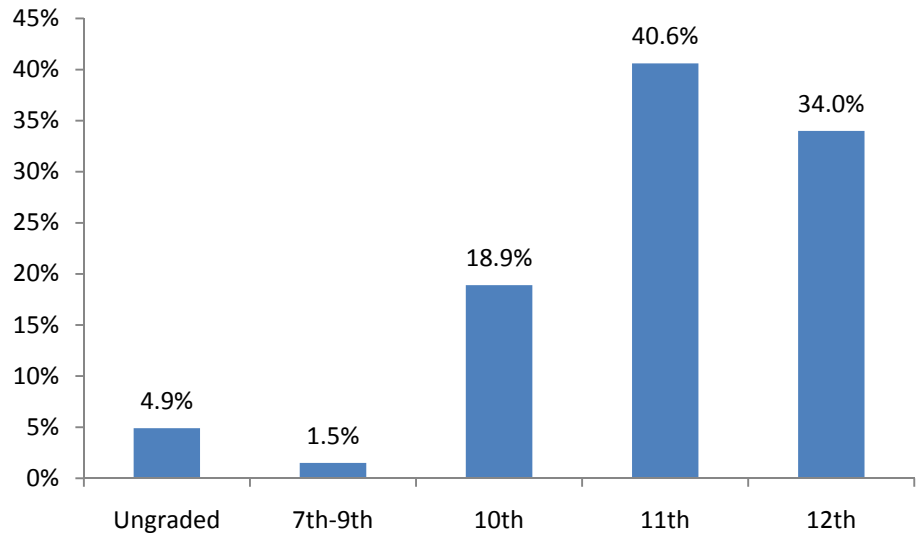
Source: Office of Special Education Programs' Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act (IDEA): 2007, Data Accountability Center, Table 2-2f, https://www.ideadata.org/arc_toc9.asp.

Academic Achievement

During the 2003-2004 school year, NLTS2 collected most-recent school-administered assessments in reading and mathematics for participating students. At the time of assessment 93.5 percent of responding students were in the 10th through 12th grades (Figure 4), and 87 percent of all reported tests were administered within one year of reporting (Figure 5). Thus it is safe to say that the reported assessments represent the reading and mathematics abilities of high school students with IEPs who are deaf or hard of hearing in the 10th through the 12th grades.

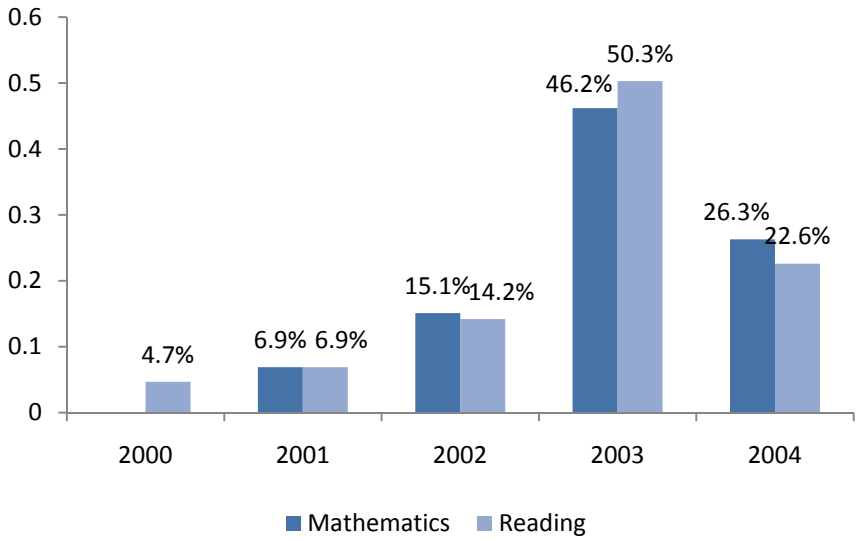
The results from the assessment (Figure 6) show that only 18.8 percent of high school students who are deaf or hard of hearing were reading at the 9th grade level or above, while 47.7 percent were reading at the 4th grade level or below. In mathematics only 21.2 percent performed at the 9th grade level or above, with 46.9 percent performing at the 4th grade level or below. These results are not unlike those reported by national

Figure 4. Grade level in 2003-04 school year for participating NLTS2 students who are deaf or hard of hearing.



Source: NLTS2 Wave 2 Student School Program Survey grand level: Table 1, (http://www.nlts2.org/data_tables/tables/9/npr2A1frm.html).

Figure 5. Year of most recent reading and mathematics ability assessment, NLTS2.

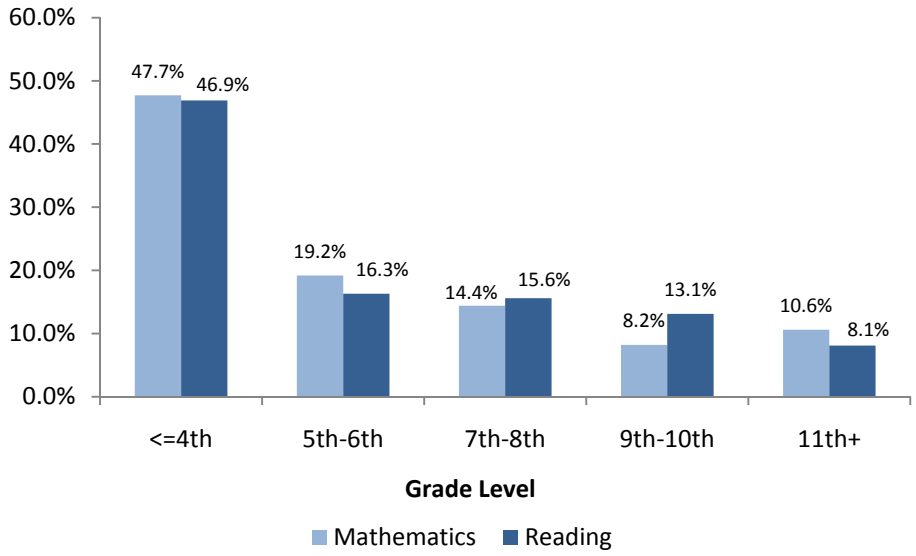


Source: NLTS2 Wave 2 Student School Program Survey assessment: Reading Table 43, (http://www.nlts2.org/data_tables/tables/9/npr2B2afrm.html) and Mathematics Table 45, (http://www.nlts2.org/data_tables/tables/9/npr2B3afrm.html).

standardized tests for students who are deaf or hard of hearing. "For the 17-year-olds and the 18-year-olds in the deaf and hard-of-hearing student norming sample [of the Stanford Achievement Test 9th Edition], the median reading comprehension subtest score corresponds to about a 4.0 grade level for hearing students. That means that half of the deaf and hard-of-hearing students at that age scored above the typical hearing student at the beginning of fourth grade, and half scored below." (Gallaudet Research Institute, Literacy and Deaf Students, http://gri.gallaudet.edu/Literacy/; Holt, Traxler, & Allen, 1997).

In addition to collecting standardized test results from school records, the NLTS2 conducted a direct assessment of student achievement abilities. The NLTS2 direct assessment used research editions of subtests of the Woodcock-Johnson III (WJ III) (Woodcock, McGrew, & Mather, 2001) battery that tests language arts skills, mathematics abilities, and content knowledge in science and social studies. The direct assessment included in NLTS2 was selected by a workgroup of assessment and measurement experts.

Figure 6. Reading and mathematics grade level at most recent assessment for high school students who are deaf or hard of hearing.



Source: NLTS2 Wave 2 Student School Program Survey Student achievement: Reading Table 44, (http://www.nlts2.org/data_tables/tables/9/npr2B2bfrm.html) and Mathematics Table 46, (http://www.nlts2.org/data_tables/tables/9/npr2B3bfrm.html).

The WJ III is a comprehensive, norm referenced, individually administered assessment of the academic skills and knowledge routinely taught in school and other settings. The WJ III tests have strong psychometric properties (Cizek, 2001) and are appropriate for administration to children as young as 2 years of age and to adults as old as 90. The WJ III subtests permit comparisons with a general population norm group assessed in 2000. The following describe the WJ III subtests (Wagner, Newman, Cameto, & Levine, 2006).

- **Passage comprehension** presents youth with a series of items that range in difficulty from easy to hard. The least difficult items present a phrase in conjunction with several graphic representations. Youth point to the appropriate picture that matches the phrase (e.g., two trees). The more difficult items are entirely text-based, address more technical topics, and require both greater vocabulary and the ability to make inferences from context.
- **Synonyms and antonyms** assesses skills in reading words, understanding vocabulary, and supplying words with similar or opposite meanings. The first

part of the subtest requires reading a word and providing a synonym (i.e., a word with the same meaning); the second requires reading a word and providing an antonym (i.e., a word with the opposite meaning).

- **Mathematics calculation** assesses computation skills, ranging in difficulty from elementary (e.g., simple addition) to advanced (e.g., integrating a function). Youth are given a worksheet that presents the mathematics problems. Youth are required to perform addition, subtraction, multiplication, division, and combinations of these basic operations, and some geometric, trigonometric, logarithmic, and calculus operations.
- **Applied problems** require youth to analyze and solve practical mathematical problems. To solve the problems, youth must recognize the procedure to be followed and then perform relatively simple calculations. Because many of the problems include extraneous information, the youth must decide not only the appropriate mathematical operations to use but also which numbers to include in the calculation.
- **Science** assesses knowledge of various areas of biological and physical sciences. The items range in difficulty from easy to hard. Early items require a youth simply to point to the appropriate response, remaining items require a youth to respond orally to questions read to him or her.
- **Social studies** assesses knowledge of history, geography, government, economics, and other aspects of social studies. Similar to the science content knowledge subtest, early items require only a pointing response, whereas remaining items require a youth to respond orally to questions read to him or her. Items range in difficulty from early preschool through college.

The results from the WJ III (Table 2) generally support results from the school-administered reading and mathematics tests. In the areas of reading comprehension, science, and social studies, about 70 percent of students who are deaf or hard of hearing score in the lower quartile (below the 25th percentile). In none of the subtests do students who are deaf or hard of hearing, as a group, score above the 50th percentile. Students who are deaf or hard of hearing scored best on the mathematical calculations subtest where, on average, they scored in the second quartile at the 38th percentile. On all other subtests they score at or below the 25th percentile.

The relatively low mathematics performance probably influences the level of mathematics courses taken by students who are deaf or hard of hearing. Figure 7 summarizes data from the 2008 National Postsecondary Student Aid Study (NAPSAS) and shows that fewer first year undergraduates who are deaf or hard of hearing have taken advanced mathematics courses (trigonometry, pre-calculus, calculus) in high

school than their hearing counterparts. While about the same percentage have taken calculus, there were fewer who have taken trigonometry or pre-calculus. This difference probably places some college freshman who are deaf or hard of hearing at an academic disadvantage, especially related to pursuit of science, technology,

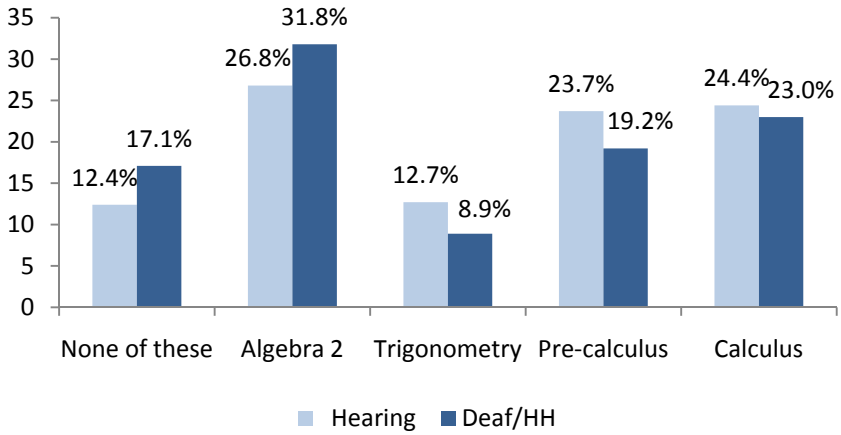
Table 2. Percent of students who are deaf or hard of hearing scoring in each quartile on the NLTS2 direct assessment tests.

Percentile	Applied problems	Calculation	Comprehension	Science	Social Studies	Synonym-Antonym
0-25	53.7%	39.9%	76.1%	70.7%	69.0%	56.7%
26-50	32.8%	18.4%	12%	14.3%	16.9%	24.4%
51-75	12.6%	29.1%	4.7%	10.1%	7.1%	12.2%
>75	0.9%	12.6%	7.3%	4.9%	7.1%	6.7%
Mean	25.1 %ile	38.4 %ile	18.4 %ile	19.7 %ile	21.8 %ile	26.0 %ile

Source: NLTS2 Direct Assessment Academic Knowledge Tables.
Applied Problems Table 4
(http://www.nlts2.org/data_tables/tables/5/ndaAP_PRfrm.html)
Calculation Table 3
(http://www.nlts2.org/data_tables/tables/5/ndacalc_prfrm.html)
Comprehension Table 2
(http://www.nlts2.org/data_tables/tables/5/ndaPC_PRfrm.html)
Science Table 6
(http://www.nlts2.org/data_tables/tables/5/ndaSci_prfrm.html)
Social Studies Table 5
(http://www.nlts2.org/data_tables/tables/5/ndaSS_prfrm.html)
Synonym-Antonym Table 1
(http://www.nlts2.org/data_tables/tables/5/ndaSyn_prfrm.html)

engineering, and mathematics majors. The reader must remember that Figure 7 presents results only for students who have been admitted to college. Thus, many of the lowest achieving students in high school would not be included in these figures, since they will not have access to postsecondary study because of their overall lower academic standing, and thus probably have taken very few higher level mathematics courses in high school.

Figure 7. Highest math course in HS for 1st year college students who are deaf or hard of hearing compared with non-disabled students.



Source: U.S. Department of Education, National Center for Education Statistics, 2007–08 National Postsecondary Student Aid Study (NPSAS:08). Calculated using the Data Analysis System http://nces.ed.gov/dasolv2/tables/index.asp.

Parental Expectations

Despite this relatively low level of achievement on the part of high school students who are deaf or hard of hearing, the majority of parents of these students still have the expectation that their sons and daughters will attend postsecondary education. When parents of students participating in the NLTS2 were asked what their expectations for postsecondary education were, 45 percent indicated their child would definitely attend a postsecondary program, while 20 percent said probably not (Table 3). This leaves about one third that were not certain about their child's future. However, about 45 percent expect that their son or daughter would earn enough to support themselves after completing their education. Caution must be exercised when interpreting questions of this nature. For example, there may be some gender bias on the part of parents, since there are still feelings that females do not need to earn enough to support themselves. Similar social/cultural norms may also apply to feelings about females attending postsecondary education, or the level of postsecondary education attended. As shown in Table 4, about two-thirds of the NLTS2 high school graduates who are deaf or hard of hearing attended some form of postsecondary educational program. Twenty-nine percent attended four-year colleges at some time while the other 71 percent attended two-year or less than two-year schools. It is interesting that these

percentages agree with percentages of parents who expected their son or daughter to attend some form of postsecondary education (Table 3). Sixty-eight percent of parents expected that their child might attend a postsecondary school.

Table 3. Parental postsecondary expectations for children who are deaf or hard of hearing participating in the NTLS2 study.

	Get regular high school diploma	Attend Postsecondary	Complete Vocational	Complete 2 year school	Complete 4yr school	Earn enough to support self
Definitely	68.0%	45.3%	22.7%	22.9%	20.2%	44.9%
Probably	22.0%	34.9%	33.2%	35.9%	36.7%	40.1%
Probably not	10.1%	19.8%	44.1%	41.3%	43.1%	15.0%

Source: NLTS2 Wave 1 Parent Expectations Tables.
Receive high school diploma, Table 214,
(http://www.nlts2.org/data_tables/tables/1/Np1J1frm.html)
Attend any postsecondary school, Table 215,
(http://www.nlts2.org/data_tables/tables/1/Np1J2frm.html)
Complete vocational technical school, Table 216,
(http://www.nlts2.org/data_tables/tables/1/Np1J3frm.html)
Complete 2 year college ,Table 217,
(http://www.nlts2.org/data_tables/tables/1/Np1J4frm.html)
Complete 4 yr school, Table 218,
(http://www.nlts2.org/data_tables/tables/1/Np1J5frm.html)
Support self, Table 223,
(http://www.nlts2.org/data_tables/tables/1/Np1J10frm.html)

Postsecondary education for students who are deaf or hard of hearing

Societal efforts to provide access to higher education discussed in the introduction have markedly influenced the numbers of hearing-impaired persons seeking postsecondary education and the access services now available. A 1999 study by the National Center on Education Statistics (U.S. Department of Education, 1999) estimated that, in 1997-98, 48 percent of the nation's 5,040 two-year and four-year postsecondary education institutions enrolled students with a hearing impairment. The total number of students reported was 23,860, not including the 2,500 enrolled at Gallaudet University and the National Technical Institute for the Deaf. In 1998 these same institutions provided a

Table 4. Type of postsecondary school attended by participants in the NTLS2 study who are deaf or hard of hearing.

School type	Percent
Vocational Technical School	26%
2 yr community college	36%
4 year college	29%
Any postsecondary school	67%

Source: NLTS2 Wave 4 Parent/Youth Survey Postsecondary school attendance tables.
Vocational/Technical school, Table 265,
(http://www.nlts2.org/data_tables/tables/13/np4S4a_D4a2frm.html)
2 year community college, Table 243,
(http://www.nlts2.org/data_tables/tables/13/np4S3a_D4a1frm.html)
4 year college, Table 284,
(http://www.nlts2.org/data_tables/tables/13/np4S5a_D4a3frm.html)
Attended any type, Table 219,
(http://www.nlts2.org/data_tables/tables/13/np4S3a_S4a_S5a_D4a1_D4a2_D4a3frm.html)

wide variety of support services (Table 5) for disabled students. Almost all (98 percent) of the institutions provided at least one support service or accommodation for students with disabilities. In 1997-98, the majority of institutions were providing altered examination formats as well as tutor and notetaker services, while fewer were

providing sign language interpretation, adaptive technologies, and special career placement services for students who were deaf or hard of hearing. While there are

Table 5. Percent of U.S. colleges providing specific support services for hearing-impaired students.

Type	Sign Language	Adaptive Technology	Notetaker	Tutor	Altered Exam Formats	Career Placement
All Institutions	45%	22%	69%	77%	88%	22%
Public 2yr	66%	81%	82%	87%	94%	32%
Private 2yr	10%	30%	18%	51%	55%	10%
Public 4yr	68%	80%	93%	82%	100%	34%
Private 4yr	29%	39%	66%	75%	90%	10%

Source: National Center for Education Statistics (U.S. Department of Education, 1999).

no known national studies of available support services at the postsecondary level for students who are deaf or hard of hearing, it can be safely assumed that the number of postsecondary schools providing these services has increased since the late 1990's.

Number in postsecondary education

The number of students who are deaf or hard of hearing varies depending on the method of determining hearing loss and the age range of the group assessed. The number 30,000 has been widely reported in the literature (Lewis & Farris, 1994; Hopkins & Walter, 1999; Billies, Buchkoski, Kolvitz, Sanderson & Walter, 2003). However, this number probably only includes those students who receive services through a university office of special services for disabled students or are enrolled in special colleges for students who are deaf or hard of hearing. The 2008 National Postsecondary Student Aid Study (NAPSAS, 2008) which asked whether a student has a hearing impairment (i.e., deaf or hard of hearing) reports that approximately 136,000

postsecondary students indicated they were deaf or hard of hearing. This number probably includes only individuals who consider themselves as deaf or hard of hearing, and who had completed the Federal Financial Aid Forms whether they require special services or not. Thus, individuals with a hearing loss who do not perceive themselves as deaf or hard of hearing probably are not included. The ACS estimated, in 2007, there were 167,000 college enrollees who are deaf or hard of hearing of all ages—birth to 99. The above numbers are considerably smaller than those reported by Schroedel, Watson, & Ashmore (2005) whose estimate of more than 400,000 students probably includes individuals with any form of hearing loss, many of whom do not identify themselves as being deaf or hard of hearing but think of themselves as hearing persons.

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What factors explain the differences between these various estimates? One possible explanation is that most students with mild to moderate losses are not requesting services, thus they do not come to the attention of campus offices of disabled student services (DSS). Secondly, hard-of-hearing students are a heterogeneous group with a wide range of needs. According to Schroedel, Kelley & Conway (2002, 2003), "(a) many decline to disclose their hearing loss or are confused by its varying effects on communication and social interaction, (b) are unaware about special services and assistive technology or do not know how or where to ask for them, or (c) consider themselves to be normal persons who hear without a disability." These results are supported by the work of Kochkin (1997) who determined that among persons needing hearing instruments, 72% had a mild loss (35dB-45dB), 21% a moderate loss (46dB-65dB), and only 7% a more severe impairment (66dB-100+dB). It could be that only individuals with the more severe impairments are seeking DSS assistance. It is not the role of this review to argue the question of how many students who are deaf or hard of hearing attend postsecondary education in the U.S. Suffice it to say that only the individual with a hearing loss can determine whether they need special support services.

So, how many students who are deaf or hard of hearing are enrolled in colleges and universities in the United States? Assuming the estimated 30,000 postsecondary students who are deaf or hard of hearing receiving DSS services is a low estimate and does not include all students who are deaf or hard of hearing, and the fact that the ACS estimates that approximately 160,000 students who are deaf or hard of hearing are enrolled in postsecondary education, it can be concluded that the number of students who may need special services is significantly less than the 400,000 estimated by Schroedel, Watson, & Ashmore (2005), but more than the estimated 30,000 currently

receiving services. It is reasonable, then, to expect that between 136,000 and 160,000 students who are deaf or hard of hearing are enrolled in postsecondary schools in the United States. These are individuals who identify themselves as having a serious hearing problem and probably think of themselves as deaf or hard of hearing.

Student Characteristics

As with hearing students, female students who are deaf or hard of hearing outnumber their male counterparts, although the percentage difference is slightly less than for hearing students. In the 2007-2008 school year, 54.3 percent of college students who were deaf or hard of hearing were female (Table 6). Almost 60 percent of hearing college students are women.

Ethnic makeup of postsecondary students who are deaf or hard of hearing also is somewhat different from their hearing peers. Table 6 shows that 76.6 percent of students who are deaf or hard of hearing are white. This compares with 69.4 percent of hearing postsecondary students who listed their ethnicity as white. While the differences between students who are hearing and those who are deaf or hard of hearing are relatively small for other ethnic categories, there are 5 percent fewer African-American students who are deaf or hard of hearing than those who are hearing.

Dependency is another area where NAPSAS data show differences between students who are hearing and those who are deaf or hard of hearing. Sixteen percent more students who are deaf or hard of hearing are classified as dependent than is the case for their hearing peers (Table 6). For federal financial aid purposes, NAPSAS considers all students to be dependent unless they meet one of the following criteria for independence:

a. Age 24 or older on December 31, 2007
b. Enrolled in a graduate or professional program beyond a bachelor's degree
c. Married
d. Orphan or ward of the court
e. Have legal dependents other than a spouse
f. A veteran of the U.S. Armed Forces
g. U.S. Armed Forces active duty

Table 6. Demographic characteristics of postsecondary level students who are deaf or hard of hearing compared to students who are hearing.

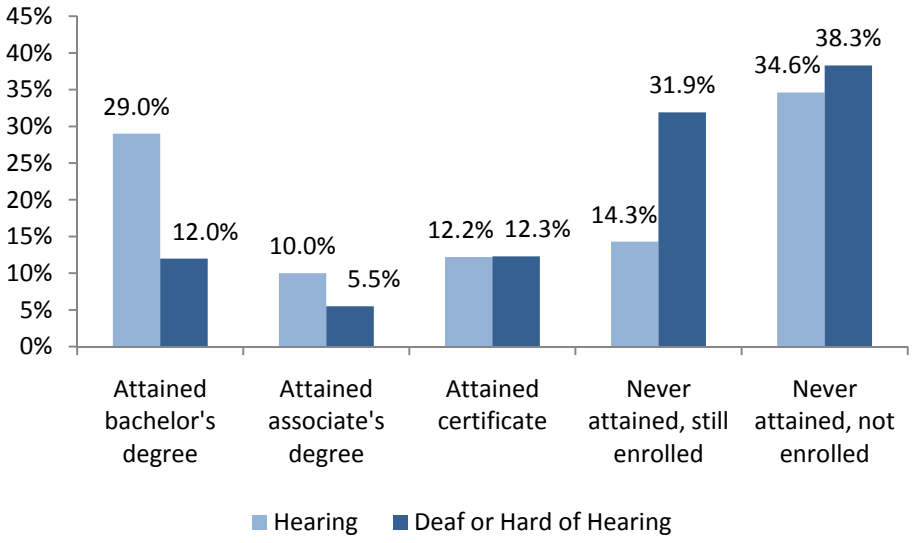
		Hearing		Deaf/Hard of Hearing	
		N	**%**	**N**	**%**
TOTAL		18,662,100	100%	136,000	100.0%
Gender					
	Male	8,043,365	43.1%	62,152	45.7%
	Female	10,618,735	56.9%	73,848	54.3%
Ethnicity					
	White	12,951,497	69.4%	104,176	76.6%
	African American	2,855,301	15.3%	14,008	10.3%
	Asian	1,231,699	6.6%	8,976	6.6%
	Native American	223,945	1.2%	1,224	0.9%
	Pacific Islander	205,283	1.1%	544	0.4%
	Other	690,498	3.7%	3,808	2.8%
	Multiracial	522,539	2.8%	3,264	2.4%
Age					
	15-23	11,271,908	60.4%	61,472	45.2%
	24-29	3,172,557	17.0%	34,000	25.0%
	30+	4,236,297	22.7%	40,528	29.8%
Dependency					
	Dependent	10,021,548	53.7%	49,776	36.6%
	Independent	8,640,552	46.3%	84,728	62.3%

Source: U.S. Department of Education, National Center for Education Statistics, 2007–08 National Postsecondary Student Aid Study, (NPSAS:08), Calculated using the Data Analysis System, http://nces.ed.gov/dasolv2/tables/index.asp.

The reason for this difference in dependency is most certainly due to the fact that students who are deaf or hard of hearing are older than their hearing peers and remain in college longer. In 2008, students who were deaf or hard of hearing were 21.4 years of age when they began their postsecondary careers while their hearing peers were almost one year younger. In addition, if one examines the age distribution of all students enrolled in 2008 (Table 6), it can be seen that 15 percent fewer enrolled students who are deaf or hard of hearing are below age 24 than their hearing peers. For all enrolled undergraduates, students who are deaf or hard of hearing average 27.8 years of age

compared to 25.7 years for their hearing counterparts. This age difference is accounted for by the fact that students who are deaf or hard of hearing are almost one year older when they begin postsecondary education, but also because they stay in school longer. According the Beginning Postsecondary Students (BPS) longitudinal study (Figure 8), 31.9 percent of students who were deaf or hard of hearing and began postsecondary studies in 1996 were still enrolled six years later. This compares with only 14.3 percent of hearing students who began their studies at the same time.

Figure 8. Six year persistence at postsecondary institutions for college students who are deaf or hard of hearing and those who are hearing in the United States—1996 to 2001.



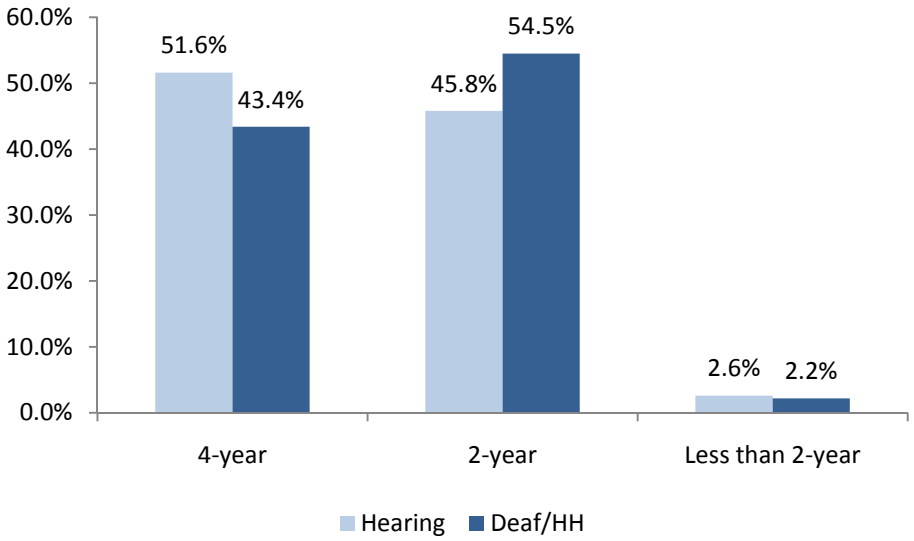
Source: U.S. Department of Education, National Center for Education Statistics, 1996/01 Beginning Postsecondary Students Longitudinal Study (BPS:96/01).

Educational Level

NAPSAS classifies institutions as four-year (colleges and universities), two-year (mostly community colleges), or less than two-year (many technical or vocational schools). From Figure 9, one can see that 57 percent of students who are deaf or hard of hearing attend two-year or less than two-year schools. This compares to 48 percent of hearing students. One reason for this difference could be the lower achievement scores described in an earlier section. The difference in type of school attended between students who are deaf or hard of hearing and those who are hearing is supported by the

degree levels pursued by students. Figure 10 shows that 60 percent of students who are deaf or hard of hearing are pursuing associate or less than two year degrees. Only

Figure 9. Institution level of college students who are deaf and hard of hearing and hearing college students in the United States - 2008.



Source: U.S. Department of Education, National Center for Education Statistics, 2007–08 National Postsecondary Student Aid Study (NPSAS:08). Calculated using the Data Analysis System, http://nces.ed.gov/dasolv2/tables/index.asp.

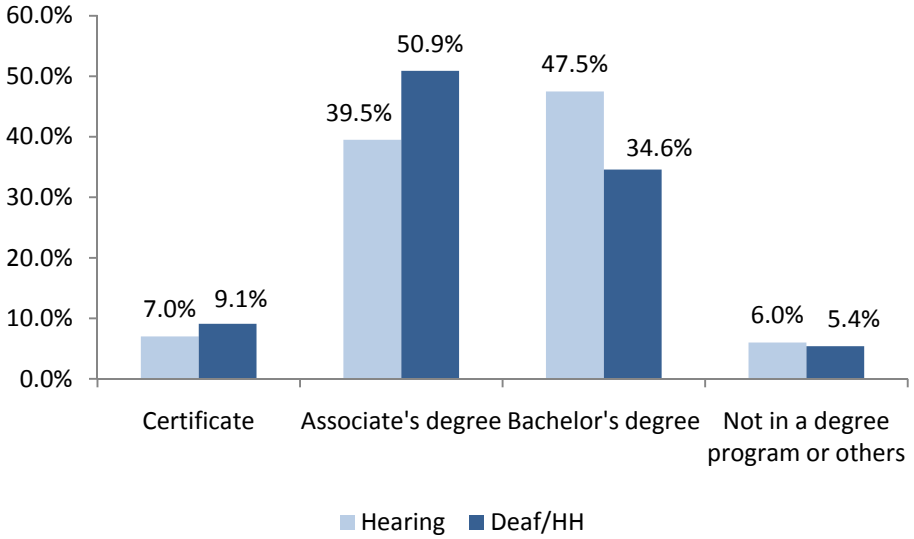
one-third are pursuing a bachelor's degree compared to 47 percent of hearing students. As a result, a higher percentage of students who are deaf or hard of hearing are enrolled as first- and second-year students than is the case with their hearing peers (Figure 11). Seventy-three percent of students who are deaf or hard of hearing versus 67 percent of students who are hearing are first- or second-year students.

Field of Study

In the previous section, statistics concerning the type of school and degree levels of students who are deaf or hard of hearing were presented. This section focuses on the major areas of study with particular attention to majors in Science, Technology, Engineering, and Mathematics (STEM). Table 7 groups majors by STEM, social sciences, other, and no defined major area of study. It also lists the percentage of

students who are deaf or hard of hearing and those who are hearing that registered in each area during the 2007-2008 school year. A smaller percentage of students who are deaf or hard of hearing registered in STEM majors at four year schools than was the case for their hearing peers. As shown in Table 8, the difference is primarily accounted for by lower rates for majors in computer and information science and physical sciences.

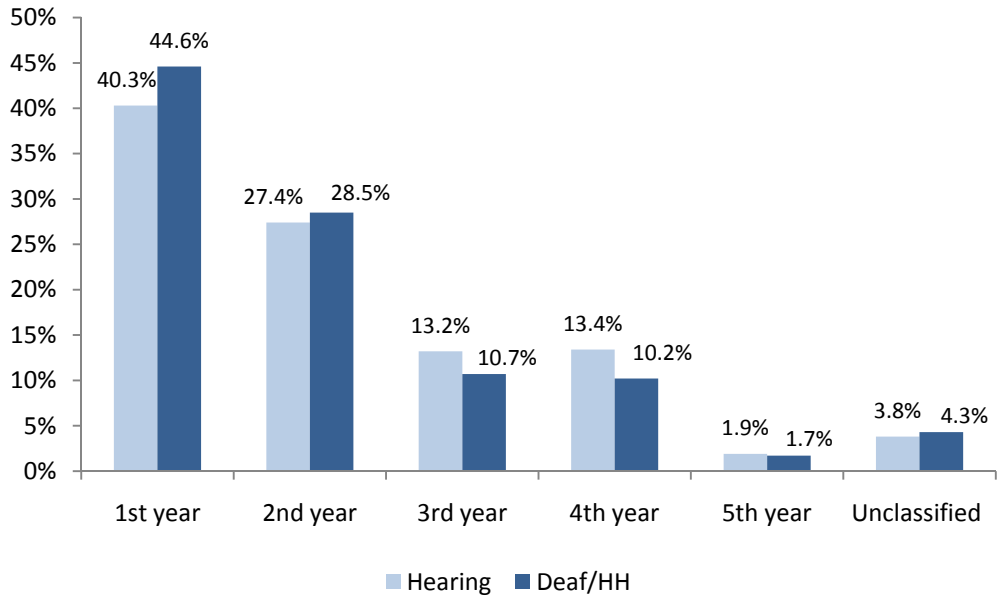
Figure 10. Degree level of deaf and hard of hearing and hearing college students in the United States - 2008.



Source: U.S. Department of Education, National Center for Education Statistics, 2007–08 National Postsecondary Student Aid Study (NPSAS:08). Calculated using the Data Analysis System, http://nces.ed.gov/dasolv2/tables/index.asp.

At two year schools, a higher percentage of students who are deaf or hard of hearing are registered in STEM majors than was the case for hearing students. Biological, biomedical, and science technologies account for the majority of the difference (Table 8). As in four year colleges, proportionally fewer students at two year colleges who are deaf or hard of hearing major in computer and information sciences. At less than two year schools, proportionally more students who are deaf or hard of hearing register in biological and biomedical sciences and engineering areas than their hearing peers, while fewer registered in computer and information sciences.

Figure 11. Class level of deaf and hard of hearing and hearing college students in the United States - 2008.



Source: U.S. Department of Education, National Center for Education Statistics, 2007–08 National Postsecondary Student Aid Study (NPSAS:08). Calculated using the Data Analysis System, http://nces.ed.gov/dasolv2/tables/index.asp.

Table 7. Percentage of hearing and hearing impaired students in STEM and non STEM majors by level of education.

	4 year		2 year		<2 year	
	Hearing N=9,427,100	Deaf/HH N=56,500	Hearing N=7,633,800	Deaf/HH N=70,10	Hearing N=479,900	Deaf/HH N=2,800
Math/Computer/Sciences/Engineering /Technologies	18.2%	17.0%	9.7%	13.2%	6.0%	6.2%
Social/behavioral sciences	9.2%	8.4%	2.0%	1.0%	1.0%	0.0%
Non-STEM field	65.3%	64.6%	66.3%	72.2%	86.5%	86.5%
Undeclared or not in a degree program	7.3%	10.0%	22.0%	13.5%	7.5%	7.3%

Source: U.S. Department of Education, National Center for Education Statistics, 2007–08 National Postsecondary Student Aid Study (NPSAS:08).

In the social and behavioral sciences there is little difference between percentages of hearing students and percentages of students who are deaf or hard of hearing. The differences that do exist are primarily accounted for by proportionally fewer students who are deaf or hard of hearing choosing psychology as a major (Table 8).

Table 8. Percentage of hearing and hearing impaired students in various majors grouped by STEM, Social Science and non STEM majors by level of education.

Stem Majors
Social Science Majors
Other Majors
No Major

	4 year		2 year		< 2 year	
	Hearing	Hearing Impaired	Hearing	Hearing Impaired	Hearing	Hearing Impaired
Agriculture and related sciences	0.7%	1.0%	0.5%	0.0%	0.0%	0.0%
Biological and biomedical sciences	4.8%	4.7%	0.9%	4.2%	0.4%	2.5%
Computer and information sciences	3.4%	2.7%	3.3%	2.7%	1.8%	0.0%
Engineering	5.0%	5.1%	1.6%	2.1%	0.8%	3.8%
Engineering technologies/technicians	1.1%	0.8%	2.3%	2.1%	2.7%	0.0%
Mathematics and statistics	0.8%	0.8%	0.3%	0.1%	0.0%	0.0%
Natural resources and conservation	0.4%	0.8%	0.1%	0.1%	0.0%	0.0%
Physical sciences	1.4%	0.6%	0.4%	0.2%	0.1%	0.0%
Science technologies/technicians	0.1%	0.3%	0.3%	1.6%	0.1%	0.0%
Geography	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%
International relations and affairs	0.4%	0.2%	0.1%	0.0%	0.0%	0.0%
Political science and government	1.7%	1.8%	0.2%	0.4%	0.0%	0.0%
Psychology	4.5%	3.5%	1.2%	0.6%	0.1%	0.0%
Social sciences, other	0.4%	0.3%	0.2%	0.0%	0.0%	0.0%
Sociology	1.1%	1.4%	0.2%	0.0%	0.0%	0.0%
Anthropology	0.4%	0.1%	0.0%	0.0%	0.0%	0.0%
Architecture, planning, related services	0.7%	0.9%	0.2%	0.0%	0.1%	0.0%
Area, ethnic, and gender studies	0.2%	0.7%	0.0%	0.0%	0.0%	0.0%
Business, management, and marketing	20.6%	18.5%	12.4%	14.9%	3.1%	3.9%
Communication and journalism	3.4%	2.2%	0.5%	1.3%	0.0%	0.0%
Communications technologies/technicians	0.2%	0.4%	0.3%	0.0%	0.1%	0.0%
Construction trades	0.1%	0.1%	0.9%	0.1%	1.6%	3.3%
Criminology	0.3%	0.4%	0.0%	0.0%	0.0%	0.0%
Economics	0.9%	1.2%	0.1%	0.0%	0.0%	0.0%
Education	7.3%	10.7%	4.6%	3.2%	0.4%	0.0%
English language and literature/letters	1.9%	1.8%	0.4%	0.4%	0.1%	0.0%
Family, consumer, and human sciences	1.0%	1.4%	0.8%	0.0%	0.2%	0.0%

Foreign languages and literatures	0.7%	0.8%	0.2%	0.0%	0.0%	0.0%
Health professions and related sciences	9.5%	8.5%	18.1%	20.6%	43.1%	38.7%
History	1.4%	1.1%	0.2%	0.4%	0.0%	0.0%
Legal professions and studies	0.6%	0.1%	1.0%	1.6%	0.5%	0.0%
Liberal arts, sciences and humanities	4.2%	1.7%	14.9%	11.0%	0.0%	0.0%
Library science	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
Mechanic and repair technologies	0.1%	0.6%	1.8%	2.3%	4.5%	2.1%
Military Technologies	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Multi/interdisciplinary studies	1.4%	0.6%	1.0%	1.1%	0.0%	0.0%
Parks, recreation, and fitness studies	1.2%	0.3%	0.3%	0.3%	0.0%	0.0%
Personal and culinary services	0.4%	0.0%	1.3%	5.0%	28.4%	33.6%
Philosophy and religious studies	0.6%	1.4%	0.1%	0.0%	0.0%	0.0%
Precision production	0.0%	0.0%	0.5%	0.8%	1.5%	0.0%
Public administration/social services	1.1%	2.2%	0.5%	0.5%	0.0%	0.0%
Security and protective services	2.7%	5.7%	3.7%	5.0%	1.2%	4.9%
Theology and religious vocations	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%
Transportation and materials moving	0.3%	0.0%	0.2%	0.0%	0.6%	0.0%
Visual and performing arts	5.1%	4.6%	2.4%	3.7%	1.2%	0.0%
Not in a degree program	2.0%	4.8%	10.7%	5.9%	2.1%	4.6%
Undeclared	5.3%	5.1%	11.3%	7.6%	5.4%	2.7%

Source*:* U.S. Department of Education, National Center for Education Statistics, 2007–08 National Postsecondary Student Aid Study (NPSAS:08).

The previous section discussed participation in postsecondary education for students who are deaf or hard of hearing. But how do individuals who are deaf or hard of hearing compare to those who are hearing in terms of their educational attainments? Table 9 compares educational attainments for individuals ages 25–64 who are deaf or hard of hearing with those who are hearing. It can be observed that 15 percent more hearing persons complete college than those who are deaf or hard of hearing. In addition, about eight percent more persons who are deaf of hard of hearing never graduate from high school. Given this lower level of educational attainment, how do persons who are deaf or hard of hearing, compete in the workforce with their better-educated hearing counterparts?

Workforce Status

Employment attainments of graduates should be a key outcome for postsecondary institutions. What is the employment rate of graduates? How do their salaries compare with those of people without degrees? What is the effect of degree attainment on participation in the labor force, the type of job one has, and compensation for work? These questions will be addressed in this section.

Table 9. Highest level of education attained by persons who are deaf or hard of hearing and those who are hearing: ages 25-64.

	< High School	High School/ GED	Some College	College Degree
Deaf/HH	20.5%	32.7%	23.7%	23.0%
Hearing	12.6%	27.0%	22.1%	38.3%

Source: 2008 American Community Survey public use data sample. Table constructed using Data Ferret.

The higher the degree, the greater the gap between the earnings of college graduates and high school graduates. In the U.S. workforce, a person with an associate degree can expect to earn 22 percent more than a high school graduate who is working, and a graduate with a bachelor's degree can expect to earn 62 percent more than a high school graduate (U.S. Census Bureau, 2004).

College graduation also has a significant impact on increasing the economic status of persons who are deaf or hard of hearing by lessening the handicapping effects of hearing loss. Welsh & MacLeod-Gallinger (1992) reported a 34 percent difference between sub-bachelor graduates and college dropouts, and an 80 percent difference in earnings between bachelor graduates and college dropouts. In a more recent study, Schroedel and Geyer (2001) report earnings differences of 26 percent between associate and bachelor graduates from a national longitudinal study of deaf and hard-of-hearing college alumni.

Findings by Walter, Clarcq, & Thompson (2002) indicate that graduation from college results in major economic benefits for deaf and hard-of-hearing persons. They estimated that deaf baccalaureate graduates will earn about 68% more over their working lives than students who attended but withdrew without a degree. Sub-baccalaureate graduates will earn 29% more than those who withdraw. These figures are in keeping with national statistics for the general population.

Walter, Clarcq & Thompson (2002) also report on the effect of gender on earnings. Salaries of deaf females are about 75 percent of deaf male salaries at graduation and are only about 60 percent at age 40. This fact needs to be tempered by the differing career choices made by males and females. For example, in the bachelor degree cohorts, 73 percent of male graduates majored in business, science, applied science and other higher paying majors. Conversely, 58 percent of females received their bachelor's degree in imaging arts and liberal arts, while only 27 percent of males received degrees in majors where lower salaries often are a market condition (Barnartt & Christiansen, 1996, MacLeod, 1992; Schroedel, 1976). Additionally, because of social forces, deaf women participate in the workforce at a lower rate than men. These differences are not unique to deaf or hard-of-hearing graduates, and are further exacerbated by institutional bias in the workforce that affects all women (Horn & Zahn, 2001; Ehrenberg & Smith, 1994). These findings suggest that the economic handicapping effects of severe to profound hearing impairment are somewhat reduced as one achieves higher levels of education beyond high school.

Employment Status

Employment statistics for persons who are deaf or hard of hearing compared with persons who are hearing are summarized in Table 10. It can be seen that in 2007 approximately 59 percent of persons who are deaf or hard of hearing, ages 25-64, participated in the labor force compared to almost 80 percent for persons who are hearing. In addition, while the overall unemployment rate for hearing persons, as a group, was 4.9 percent, it was 7.7 percent for persons who are deaf and hard of hearing. Also, persons who are deaf or hard of hearing had earnings that amounted to 64 percent of their hearing peers: $22,762 in 2007 for those who are deaf or hard of hearing compared to $35,531 in the same year for hearing persons. There are significant differences due to gender for both groups; the gender difference is greater for women who are deaf or hard of hearing than for hearing women. The fact of significantly lower participation, higher unemployment, and lower wages for persons who are deaf or hard

of hearing highlights the difficulty this minority group has in competing in the workplace.

Occupation

Given the relatively poor employment status of persons who are deaf or hard of hearing when compared to persons who are hearing, the next logical question concerns the types of jobs individuals who are deaf or hard of hearing have when they are employed. The percentage of workers employed in 25 occupational areas by hearing status and gender is listed in Table 11.

A review of Table 11 indicates that higher percentages of persons who are deaf or hard of hearing are employed in traditionally blue collar occupations such as production, transportation, and construction than in white collar jobs such as office work, sales, management, education, medical, computer, and financial areas. These white collar jobs usually require higher levels of education and good communication skills, and tend to pay higher wages.

Table 10. Percentage of 25-64 year old hearing and hearing impaired students in the labor force, unemployed, with average earnings.

	N	In labor force	Unemployed	Earnings
Total 25 - 64	161,220,773	79.1%	5.0%	$35,216
Male	80,084,467	85.0%	5.0%	$44,594
Female	81,136,306	73.3%	5.0%	$25,960
Deaf/HH	3,971,758	58.7%	7.7%	$22,762
Male	2,562,842	62.6%	7.4%	$27,211
Female	1,408,916	51.7%	8.4%	$14,669
Hearing	157,249,015	79.6%	4.9%	$35,531
Male	77,521,625	85.7%	5.0%	$45,169
Female	79,727,390	73.7%	4.9%	$26,159

Source: 2008 American Community Survey public use data sample. Table constructed using Data Ferret.

Taken together, Tables 10 and 11 show that persons who are deaf or hard of hearing, ages 25-64, clearly underperform when compared to the hearing cohort of workers. Not only do they participate in the workforce at a much lower rate, but they are more likely to be unemployed if they do participate. When they do have a job, the job is more likely to be of a manual nature. To investigate this finding the effect of education on improving the work status of persons who are deaf or hard of hearing will be examined.

Effect of Education

Figure 12 shows the effect of education on improving participation in the labor force by persons who are deaf or hard of hearing. As described above, persons who are deaf or hard of hearing participate in the work place at lower rates than hearing persons. While the lower participation rate persists at all educational levels, the gap is far larger for those who have not completed a postsecondary education program. Overall, 70 percent or more of college graduates who are deaf or hard of hearing are in the labor force while only about 50 percent of those with no postsecondary certification participate. Looked at in a different way, the gap between persons who are deaf or hard of hearing and those who are hearing ranges between 9 and 15 percentage points for college graduates, while the difference ranges from 17 to 26 percentage points for those without

Table 11. Percentage of workers (25-64) who are hearing and those who are deaf or hard of hearing by occupational area and gender.

	Deaf/HH			Hearing		
OCCUPATIONAL AREA	Overall	Male	Female	Overall	Male	Female
OFFICE SUPPORT	11.2%	6.4%	21.4%	13.9%	6.3%	22.1%
PRODUCTION	10.9%	12.6%	7.2%	6.8%	8.9%	4.5%
TRANSPORTATION	9.5%	12.5%	3.2%	6.1%	9.8%	2.2%
CONSTRUCTION	9.4%	13.5%	0.7%	6.2%	11.7%	0.4%
SALES	8.6%	7.7%	10.6%	10.2%	9.8%	10.6%
MANAGEMENT	8.5%	9.7%	5.9%	10.1%	11.9%	8.2%
CLEANING	6.1%	6.1%	6.0%	4.0%	4.4%	3.6%
REPAIR	5.6%	8.1%	0.4%	3.4%	6.3%	0.3%
FOOD SERVICES	3.9%	2.4%	7.0%	4.0%	3.2%	5.0%
EDUCATION	3.9%	2.1%	7.7%	6.2%	2.9%	9.7%
PERSONAL SERVICES	2.7%	1.2%	6.0%	3.1%	1.1%	5.2%

MEDICAL	2.7%	1.3%	5.6%	5.3%	2.5%	8.2%
SECURITY SERVICES	2.6%	3.2%	1.1%	2.1%	3.2%	1.0%
HEALTH SERVICES	2.0%	0.4%	5.4%	2.3%	0.5%	4.3%
BUSINESS	1.8%	1.7%	1.9%	2.2%	1.9%	2.6%
COMPUTER	1.6%	1.9%	1.1%	2.5%	3.4%	1.4%
ENGINEERING	1.5%	2.1%	0.2%	1.9%	3.2%	0.6%
FINANCE	1.4%	1.1%	2.1%	2.4%	2.0%	2.8%
HELPING SERVICES	1.3%	1.0%	2.1%	1.6%	1.1%	2.2%
ENTERTAINMENT	1.3%	1.2%	1.5%	1.9%	1.9%	1.9%
AGRICULTURE	1.0%	1.2%	0.4%	0.7%	1.0%	0.4%
LEGAL	0.6%	0.6%	0.8%	1.2%	1.0%	1.3%
SCIENCE	0.5%	0.6%	0.4%	0.9%	1.0%	0.9%
MILITARY	0.4%	0.6%	0.0%	0.3%	0.5%	0.1%
EXTRACTION	0.3%	0.5%	0.0%	0.2%	0.3%	0.0%
UNEMPLOYED	0.6%	0.5%	1.0%	0.4%	0.3%	0.5%

Source: 2008 ACS Public use data sample. Table constructed using Data Ferret.

postsecondary certification. It is not the role of this paper to discuss the reasons for these differences in labor force participation, but suffice it to say that education goes a long way to improving participation, even though there is a gap between persons who are deaf or hard of hearing and those who are hearing at all educational levels.

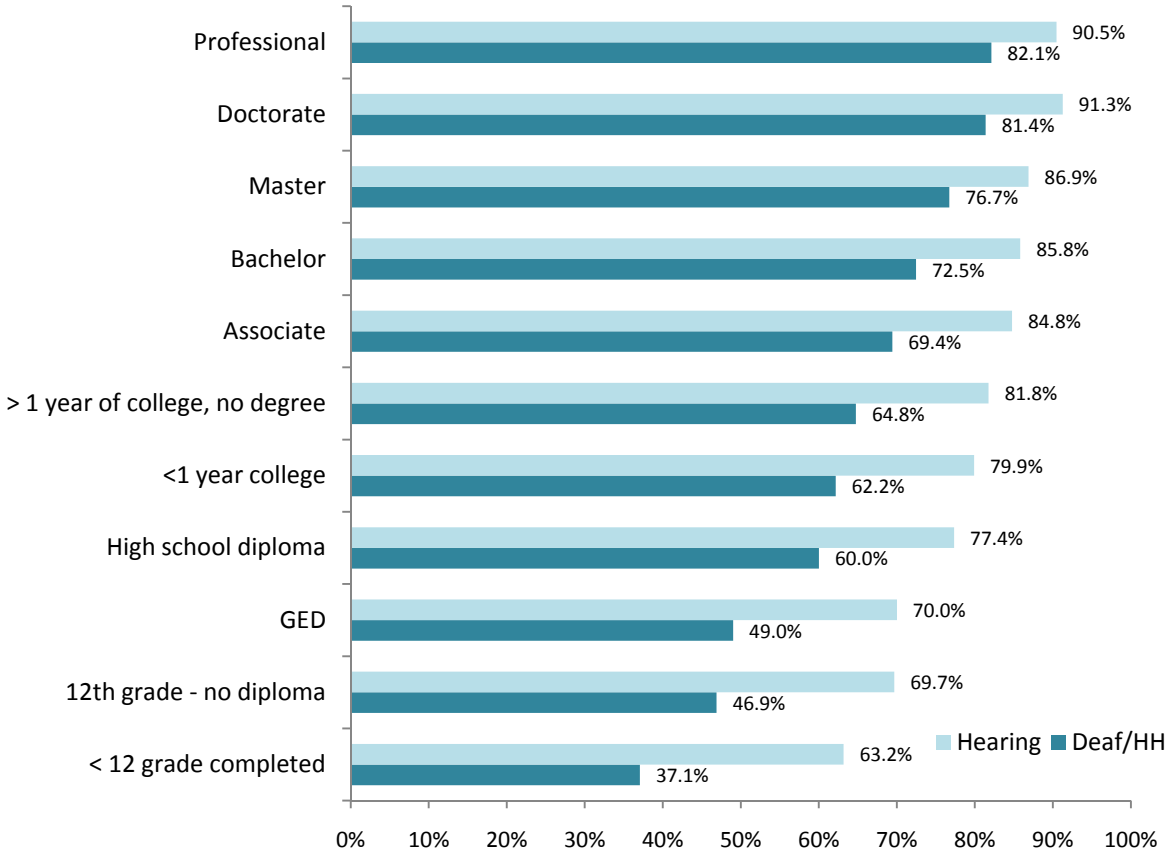
As is the case with labor force participation, the higher the postsecondary degree achieved by persons who are deaf or hard of hearing, the lower the unemployment rate (Figure 13), and more like the rates for hearing persons. Also, Figure 13 shows that there is little benefit for persons who are deaf or hard of hearing who begin college and do not graduate. As a matter of fact, Figure 13 shows that unemployment rates for persons who are deaf or hard of hearing with some college (< one year, and > one year—no degree), are higher than for persons who are deaf or hard of hearing with only a high school diploma. Similar findings have been reported by Walter, Clarcq, & Thompson (2002) from studies with alumni of the National Technical Institute for the Deaf. These findings reinforce the importance of completing a college degree.

Earnings

Given the differences between hearing persons and persons who are deaf or hard of hearing in terms of labor force participation, types of jobs obtained, and relative

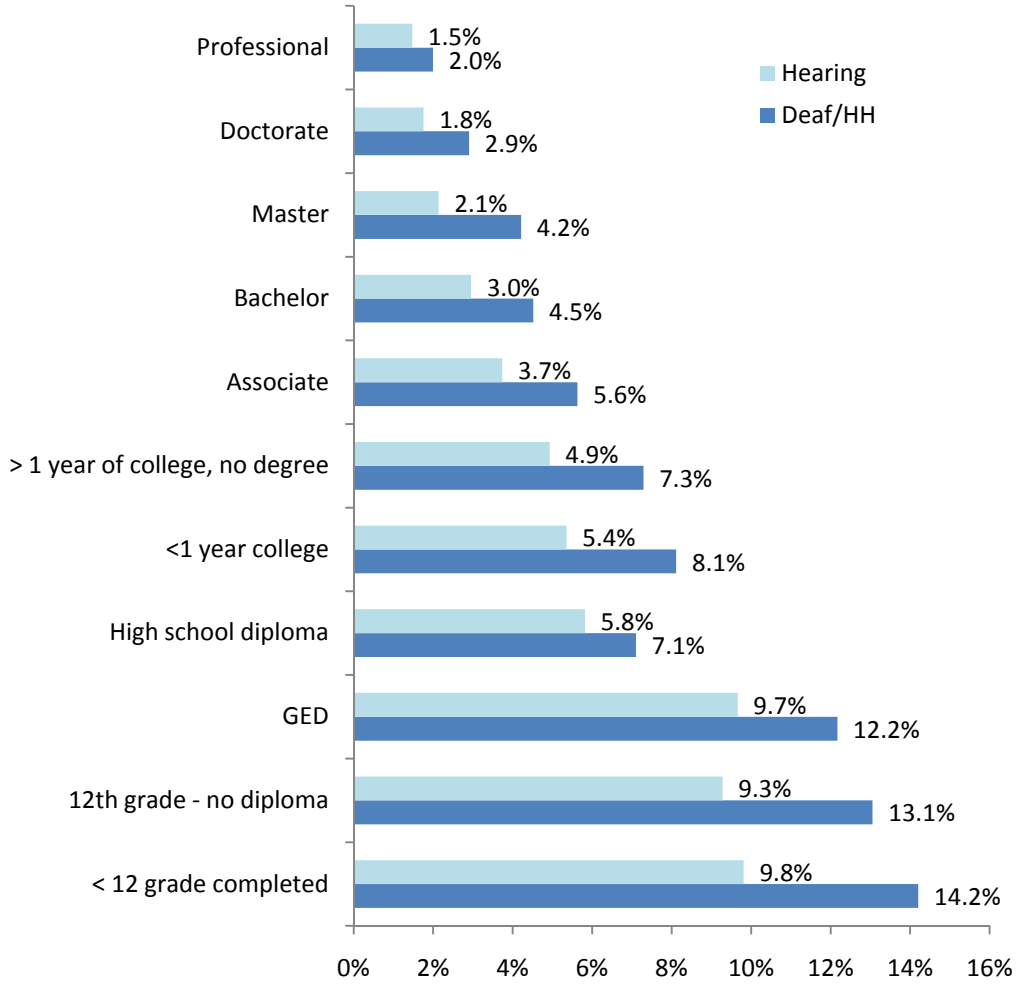
educational attainments, it is not surprising that there also are differences in earnings. Estimates from the ACS indicate that persons who are deaf or hard of hearing had earnings that amounted to 64 percent of their hearing peers: $22,762 in 2007 for those who are deaf or hard of hearing compared to $35,531 in the same year for hearing persons. Figure 14 displays these differences by educational attainment. As might be expected, education improves earnings for both hearing and those who are deaf or hard

Figure 12. Labor force participation rate for hearing and hearing impaired persons ages 25-64 by level of education completed.



Source: 2008 American Community Survey public use data sample. Table constructed using Data Ferret.

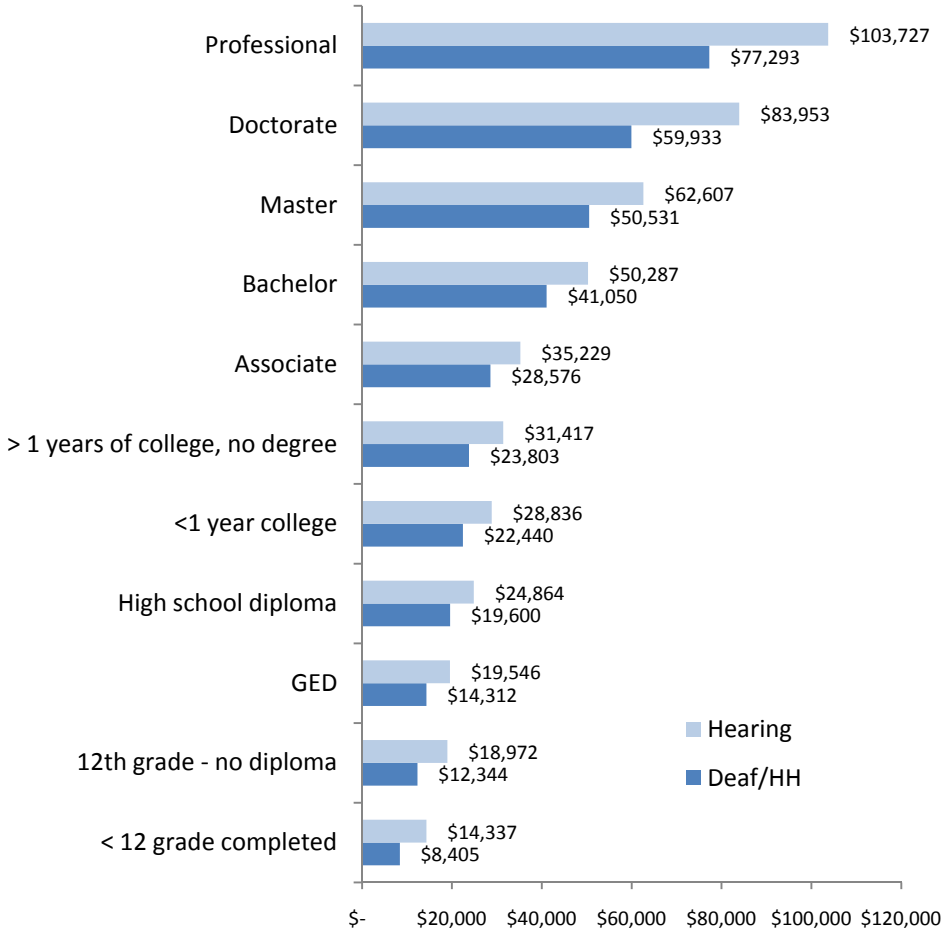
Figure 13. Unemployment rate for hearing and hearing impaired persons ages 25-64 by level of education completed.



Source: 2008 ACS Public use data sample. Table constructed using Data Ferret.

of hearing. For workers who are deaf or hard of hearing, college graduates earned 2.3 times more than non-college graduates: $40,511 compared to $17,448 for non graduates. However, the effect of completing some form of college has only little impact on reducing the percentage difference between earnings of those who are deaf or hard of hearing and those who are hearing.

Figure 14. Average earnings for persons who are hearing and those who are deaf or hard of hearing ages 25-64 by level of education completed.



Source: 2008 ACS Public use data sample. Table constructed using Data Ferret.

Employment in STEM occupations

In this section, comparisons are made between persons who are hearing and those who are deaf or hard of hearing in terms of their employment in STEM occupations. The occupations listed in Table 12 were selected as representing STEM occupations from the occupations listed by the ACS—2008. Overall, 15.5 percent of workers who are deaf or hard of hearing and 17.9 percent of persons who are hearing are employed in STEM occupations. However, as with occupations in general, there are differences in the types of STEM jobs in which the two groups are employed. Higher percentages of hearing persons tend to work in computer and medical fields, while higher percentages of persons who are deaf or hard of hearing tend to work in construction, mechanical, and

agricultural areas. A thorough examination of Table 12 shows that, as with occupations in general, persons who are deaf or hard of hearing tend to be employed at higher rates in STEM occupations that are considered blue collar, while higher percentages of persons who are hearing are employed in emerging technical fields related to information technology and health care. These same fields also require higher levels of education for entry.

Table 12. Percentage of 25-64 year old hearing and hearing impaired workers employed in STEM occupations.

Occupation	Deaf/HH	Hearing	Difference
CMM-ACTUARIES	0.00%	0.01%	-0.0119%
CMM-COMPUTER SUPPORT SPECIALISTS	0.20%	0.32%	-0.1181%
CMM-NETWORK SYSTEMS AND DATA COMMUNICATIONS ANALYSTS	0.17%	0.25%	-0.0840%
ENG-DRAFTERS	0.17%	0.14%	0.0278%
ENG-ENGINEERING TECHNICIANS, EXCEPT DRAFTERS	0.37%	0.31%	0.0568%
ENG-SURVEYING AND MAPPING TECHNICIANS	0.05%	0.06%	-0.0109%
MED-CLINICAL LABORATORY TECHNOLOGISTS AND TECHNICIANS	0.12%	0.23%	-0.1121%
MED-DIAGNOSTIC RELATED TECHNOLOGISTS AND TECHNICIANS	0.11%	0.21%	-0.0963%
MED-HEALTH DIAGNOSING AND TREATING PRACTITIONER SUPPORT TECHNICIANS	0.20%	0.30%	-0.1010%
MED-MEDICAL RECORDS AND HEALTH INFORMATION TECHNICIANS	0.04%	0.07%	-0.0257%
MED-MISCELLANEOUS HEALTH TECHNOLOGISTS AND TECHNICIANS	0.07%	0.09%	-0.0165%
OFF-COMPUTER OPERATORS	0.08%	0.10%	-0.0194%
PRD-COMPUTER CONTROL PROGRAMMERS AND OPERATORS	0.06%	0.05%	0.0081%
PRD-ELECTRICAL, ELECTRONICS, AND ELECTROMECHANICAL ASSEMBLERS	0.19%	0.14%	0.0509%
PRD-MEDICAL, DENTAL, AND OPHTHALMIC LABORATORY TECHNICIANS	0.05%	0.06%	-0.0163%
RPR-AIRCRAFT MECHANICS AND SERVICE TECHNICIANS	0.18%	0.12%	0.0651%
RPR-AVIONICS TECHNICIANS	0.03%	0.01%	0.0138%
RPR-COMPUTER, AUTOMATED TELLER, AND OFFICE MACHINE REPAIRERS	0.24%	0.18%	0.0582%

RPR-ELECTRICAL AND ELECTRONICS REPAIRERS, TRANSPORTATION EQUIPMENT, AND INDUSTRIAL AND UTILITY	0.04%	0.02%	0.0229%
SCI-AGRICULTURAL AND FOOD SCIENCE TECHNICIANS	0.03%	0.02%	0.0130%
SCI-BIOLOGICAL TECHNICIANS	0.01%	0.01%	-0.0046%
SCI-CHEMICAL TECHNICIANS	0.05%	0.06%	-0.0081%
SCI-GEOLOGICAL AND PETROLEUM TECHNICIANS	0.01%	0.01%	-0.0027%
SCI-MISCELLANEOUS LIFE, PHYSICAL, AND SOCIAL SCIENCE TECHNICIANS, INCLUDING SOCIAL SCIENCE RESEARCH	0.05%	0.09%	-0.0345%
CMM-COMPUTER PROGRAMMERS	0.25%	0.36%	-0.1026%
CMM-COMPUTER SCIENTISTS AND SYSTEMS ANALYSTS	0.37%	0.55%	-0.1812%
CMM-COMPUTER SOFTWARE ENGINEERS	0.37%	0.59%	-0.2241%
CMM-DATABASE ADMINISTRATORS	0.07%	0.08%	-0.0078%
CMM-MISCELLANEOUS MATHEMATICAL SCIENCE OCCUPATIONS, INCLUDING MATHEMATICIANS AND STATISTICIANS	0.01%	0.03%	-0.0204%
CMM-NETWORK AND COMPUTER SYSTEMS ADMINISTRATORS	0.13%	0.17%	-0.0425%
CMM-OPERATIONS RESEARCH ANALYSTS	0.05%	0.08%	-0.0339%
CON-CONSTRUCTION AND BUILDING INSPECTORS	0.12%	0.08%	0.0412%
CON-ELECTRICIANS	0.88%	0.56%	0.3208%
CON-HAZARDOUS MATERIALS REMOVAL WORKERS	0.02%	0.02%	-0.0037%
ENG-AEROSPACE ENGINEERS	0.07%	0.09%	-0.0289%
ENG-ARCHITECTS, EXCEPT NAVAL	0.04%	0.14%	-0.1005%
ENG-BIOMEDICAL AND AGRICULTURAL ENGINEERS	0.02%	0.01%	0.0068%
ENG-CHEMICAL ENGINEERS	0.02%	0.04%	-0.0207%
ENG-CIVIL ENGINEERS	0.17%	0.21%	-0.0454%
ENG-COMPUTER HARDWARE ENGINEERS	0.02%	0.04%	-0.0191%
ENG-ELECTRICAL AND ELECTRONICS ENGINEERS	0.10%	0.17%	-0.0621%
ENG-ENVIRONMENTAL ENGINEERS	0.01%	0.02%	-0.0117%
ENG-INDUSTRIAL ENGINEERS, INCLUDING HEALTH AND SAFETY	0.09%	0.12%	-0.0388%
ENG-MARINE ENGINEERS AND NAVAL ARCHITECTS	0.00%	0.01%	-0.0094%
ENG-MATERIALS ENGINEERS	0.03%	0.03%	0.0066%
ENG-MECHANICAL ENGINEERS	0.12%	0.17%	-0.0510%
ENG-MISCELLANEOUS ENGINEERS, INCLUDING NUCLEAR ENGINEERS	0.17%	0.31%	-0.1444%
ENG-PETROLEUM, MINING AND GEOLOGICAL ENGINEERS, INCLUDING MINING SAFETY ENGINEERS	0.03%	0.02%	0.0054%
ENG-SURVEYORS, CARTOGRAPHERS, AND PHOTOGRAMMETRISTS	0.01%	0.03%	-0.0167%

EXT-EXPLOSIVES WORKERS, ORDNANCE HANDLING EXPERTS, AND BLASTERS	0.03%	0.01%	0.0191%
FFF-AGRICULTURAL INSPECTORS	0.04%	0.01%	0.0259%
FFF-FISHING AND HUNTING WORKERS	0.05%	0.03%	0.0171%
FFF-FOREST AND CONSERVATION WORKERS	0.00%	0.01%	-0.0036%
FFF-GRADERS AND SORTERS, AGRICULTURAL PRODUCTS	0.03%	0.03%	0.0050%
FFF-MISCELLANEOUS AGRICULTURAL WORKERS, INCLUDING ANIMAL BREEDERS	0.59%	0.50%	0.0935%
HLS-DENTAL ASSISTANTS	0.11%	0.18%	-0.0610%
HLS-MASSAGE THERAPISTS	0.08%	0.09%	-0.0148%
HLS-NURSING, PSYCHIATRIC, AND HOME HEALTH AIDES	1.45%	1.46%	-0.0119%
HLS-OCCUPATIONAL THERAPIST ASSISTANTS AND AIDES	0.00%	0.01%	-0.0049%
HLS-PHYSICAL THERAPIST ASSISTANTS AND AIDES	0.03%	0.04%	-0.0120%
MED-AUDIOLOGISTS	0.01%	0.01%	0.0048%
MED-CHIROPRACTORS	0.02%	0.04%	-0.0230%
MED-DENTAL HYGIENISTS	0.03%	0.10%	-0.0713%
MED-DENTISTS	0.05%	0.12%	-0.0601%
MED-DIETITIANS AND NUTRITIONISTS	0.05%	0.07%	-0.0143%
MED-EMERGENCY MEDICAL TECHNICIANS AND PARAMEDICS	0.07%	0.12%	-0.0467%
MED-HEALTH DIAGNOSING AND TREATING PRACTITIONERS, ALL OTHER	0.01%	0.01%	-0.0061%
MED-LICENSED PRACTICAL AND LICENSED VOCATIONAL NURSES	0.31%	0.49%	-0.1831%
MED-OCCUPATIONAL THERAPISTS	0.02%	0.07%	-0.0436%
MED-OPTICIANS, DISPENSING	0.02%	0.04%	-0.0110%
MED-OPTOMETRISTS	0.00%	0.03%	-0.0235%
MED-OTHER HEALTHCARE PRACTITIONERS AND TECHNICAL OCCUPATIONS	0.04%	0.05%	-0.0042%
MED-PHARMACISTS	0.11%	0.16%	-0.0565%
MED-PHYSICAL THERAPISTS	0.05%	0.13%	-0.0868%
MED-PHYSICIAN ASSISTANTS	0.02%	0.05%	-0.0302%
MED-PHYSICIANS AND SURGEONS	0.19%	0.58%	-0.3892%
MED-PODIATRISTS	0.00%	0.01%	-0.0044%
MED-RADIATION THERAPISTS	0.00%	0.01%	-0.0075%
MED-RECREATIONAL THERAPISTS	0.00%	0.01%	-0.0072%
MED-REGISTERED NURSES	0.91%	1.96%	-1.0491%
MED-RESPIRATORY THERAPISTS	0.06%	0.07%	-0.0128%
MED-SPEECH-LANGUAGE PATHOLOGISTS	0.05%	0.09%	-0.0377%
MED-THERAPISTS, ALL OTHER	0.07%	0.09%	-0.0162%
MED-VETERINARIANS	0.01%	0.06%	-0.0460%

MGR-COMPUTER AND INFORMATION SYSTEMS MANAGERS	0.23%	0.35%	-0.1179%
MGR-CONSTRUCTION MANAGERS	0.76%	0.65%	0.1054%
MGR-ENGINEERING MANAGERS	0.12%	0.11%	0.0034%
MGR-INDUSTRIAL PRODUCTION MANAGERS	0.17%	0.17%	0.0058%
MGR-MEDICAL AND HEALTH SERVICES MANAGERS	0.30%	0.37%	-0.0704%
MGR-NATURAL SCIENCES MANAGERS	0.00%	0.01%	-0.0082%
PRD-CHEMICAL PROCESSING MACHINE SETTERS, OPERATORS, AND TENDERS	0.08%	0.04%	0.0393%
PRD-ENGINE AND OTHER MACHINE ASSEMBLERS	0.02%	0.01%	0.0061%
PRD-MISCELLANEOUS PLANT AND SYSTEM OPERATORS	0.07%	0.03%	0.0368%
PRD-PHOTOGRAPHIC PROCESS WORKERS AND PROCESSING MACHINE OPERATORS	0.04%	0.04%	0.0051%
PRD-POWER PLANT OPERATORS, DISTRIBUTORS, AND DISPATCHERS	0.08%	0.04%	0.0472%
PRD-STATIONARY ENGINEERS AND BOILER OPERATORS	0.17%	0.07%	0.1036%
PRD-WATER AND LIQUID WASTE TREATMENT PLANT AND SYSTEM OPERATORS	0.07%	0.06%	0.0154%
PRS-NONFARM ANIMAL CARETAKERS	0.04%	0.10%	-0.0620%
RPR-AUTOMOTIVE SERVICE TECHNICIANS AND MECHANICS	0.83%	0.57%	0.2596%
RPR-BUS AND TRUCK MECHANICS AND DIESEL ENGINE SPECIALISTS	0.38%	0.21%	0.1787%
RPR-ELECTRIC MOTOR, POWER TOOL, AND RELATED REPAIRERS	0.03%	0.02%	0.0082%
RPR-ELECTRICAL POWER-LINE INSTALLERS AND REPAIRERS	0.13%	0.09%	0.0465%
RPR-ELECTRONIC EQUIPMENT INSTALLERS AND REPAIRERS, MOTOR VEHICLES	0.02%	0.01%	0.0073%
RPR-ELECTRONIC HOME ENTERTAINMENT EQUIPMENT INSTALLERS AND REPAIRERS	0.05%	0.04%	0.0128%
RPR-HEATING, AIR CONDITIONING, AND REFRIGERATION MECHANICS AND INSTALLERS	0.27%	0.25%	0.0242%
RPR-HEAVY VEHICLE AND MOBILE EQUIPMENT SERVICE TECHNICIANS AND MECHANICS	0.37%	0.15%	0.2172%
RPR-MISCELLANEOUS VEHICLE AND MOBILE EQUIPMENT MECHANICS, INSTALLERS, AND REPAIRERS	0.06%	0.04%	0.0188%
RPR-PRECISION INSTRUMENT AND EQUIPMENT REPAIRERS	0.06%	0.04%	0.0169%
RPR-RADIO AND TELECOMMUNICATIONS EQUIPMENT INSTALLERS AND REPAIRERS	0.19%	0.13%	0.0666%
RPR-SECURITY AND FIRE ALARM SYSTEMS INSTALLERS	0.07%	0.04%	0.0271%
RPR-SMALL ENGINE MECHANICS	0.12%	0.03%	0.0860%

RPR-TELECOMMUNICATIONS LINE INSTALLERS AND REPAIRERS	0.10%	0.12%	-0.0189%
SCI-AGRICULTURAL AND FOOD SCIENTISTS	0.02%	0.02%	-0.0048%
SCI-ASTRONOMERS AND PHYSICISTS	0.01%	0.01%	-0.0012%
SCI-ATMOSPHERIC AND SPACE SCIENTISTS	0.00%	0.01%	-0.0064%
SCI-BIOLOGICAL SCIENTISTS	0.02%	0.06%	-0.0475%
SCI-CHEMISTS AND MATERIALS SCIENTISTS	0.04%	0.07%	-0.0262%
SCI-CONSERVATION SCIENTISTS AND FORESTERS	0.00%	0.02%	-0.0129%
SCI-ENVIRONMENTAL SCIENTISTS AND GEOSCIENTISTS	0.07%	0.06%	0.0028%
SCI-MEDICAL SCIENTISTS	0.03%	0.10%	-0.0782%
SCI-PHYSICAL SCIENTISTS, ALL OTHER	0.05%	0.11%	-0.0591%
TRN-AIRCRAFT PILOTS AND FLIGHT ENGINEERS	0.06%	0.12%	-0.0626%
TRN-SAILORS AND MARINE OILERS, AND SHIP ENGINEERS	0.02%	0.02%	0.0022%
TRN-TRANSPORTATION INSPECTORS	0.09%	0.04%	0.0559%
	15.5%	17.9%	-2.4807%

Source: 2008 ACS Public use data sample. Table constructed using Data Ferret.

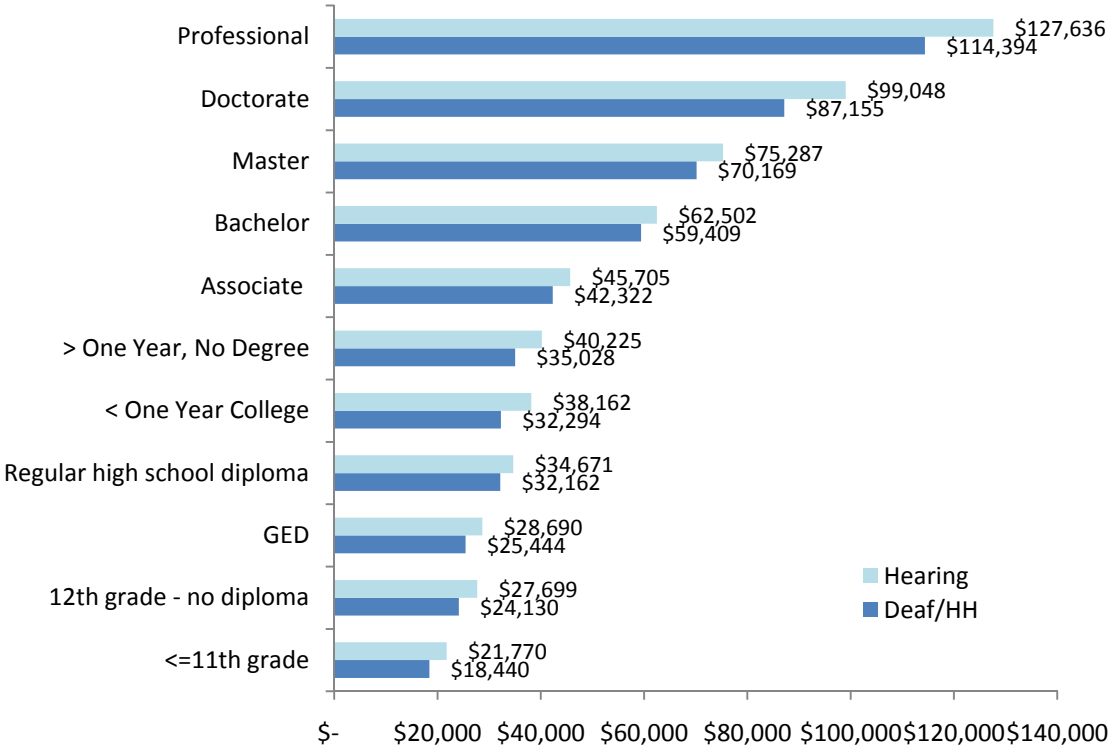
Figure 15 compares the earnings of workers in STEM occupations who are hearing and those who are deaf or hard of hearing by degree level. The differences in earnings between workers who are deaf or hard of hearing and workers who are hearing are considerably less for individuals employed in STEM occupations than for the population as a whole. On average, hearing workers in STEM occupations earned $53,317 in 2007 while those who are deaf or hard of hearing earned $41,719 over the same period—22 percent less than persons who are hearing.

Also of note is the fact that earnings are generally higher for each degree level than those for the general populations depicted in Figure 14. The exception is for those with professional degrees/certifications. It is encouraging that earnings of individuals employed in STEM occupations are higher than for the general population of hearing workers. Also, attending postsecondary education improves earnings of individuals employed in these STEM occupations.

The economic benefits of being employed in STEM occupations is further demonstrated by comparing the earnings of workers who are deaf or hard of hearing in STEM

occupations with those deaf or hard-of-hearing workers not in STEM occupations (Figure 16). It can be seen that the benefits of STEM employment accrue to all

Figure 15. Average earnings for workers who are hearing and those who are deaf or hard of hearing employed in STEM occupations by education level.



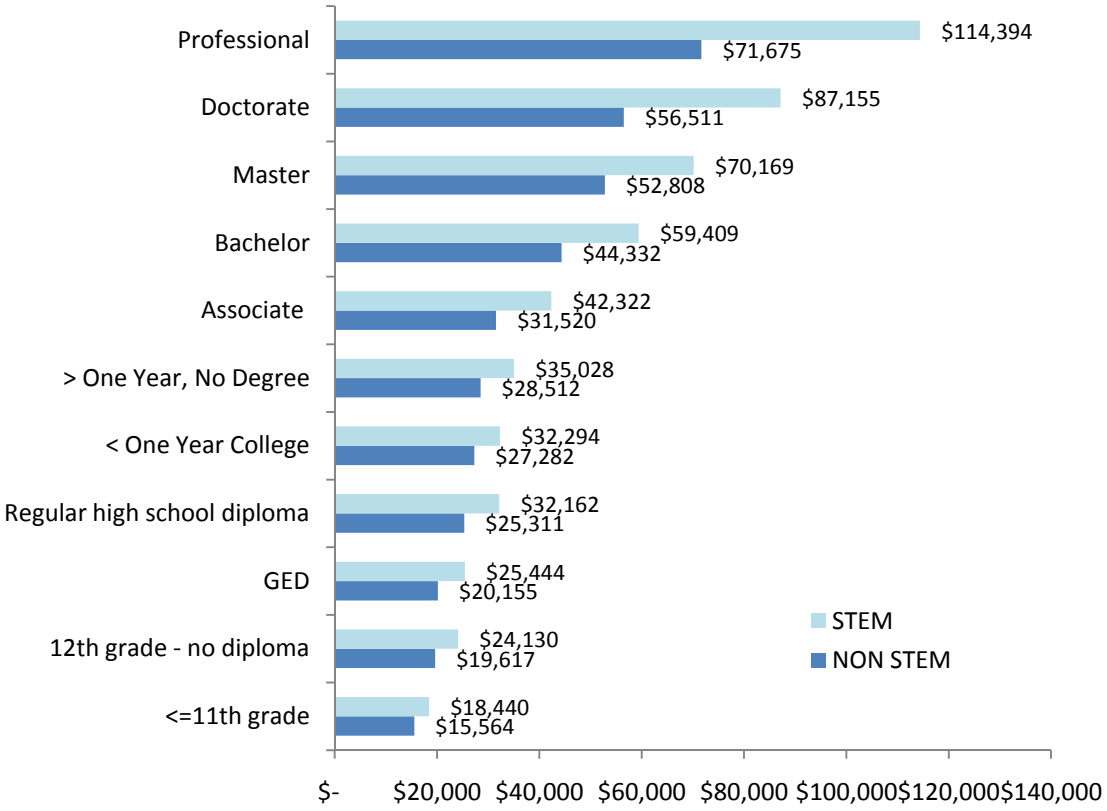
Source: 2008 ACS Public use data sample. Table constructed using Data Ferret.

educational levels, but are far more so at higher educational levels. Overall, persons who are deaf or hard of hearing who are employed in STEM occupations earn 31 percent more than persons who are deaf or hard of hearing not employed in STEM occupations.

As shown in Figure 17, 60 percent of workers in STEM occupations who are deaf or hard of hearing do not have a college degree. Only 44 percent of hearing workers do not have a college degree. As discussed above, this educational difference probably impacts the types of jobs obtained by the two groups. Deaf or hard-of-hearing workers obtain jobs in traditional blue collar areas as opposed to higher paying white

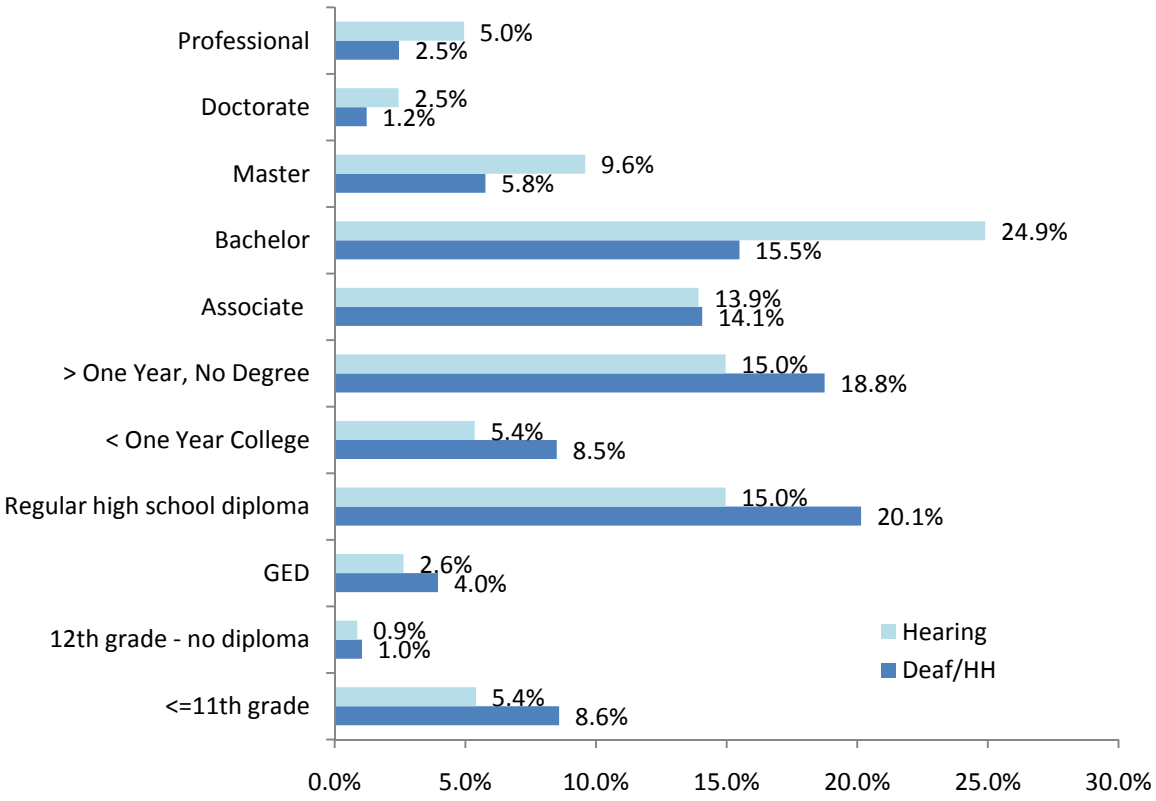
collar jobs. It is also important to note that considerably more hearing persons employed in STEM occupations have baccalaureate degrees: 24.9 percent for hearing persons compared to 15.5 percent for persons who are deaf or hard of hearing.

Figure 16. Average earnings of workers who are deaf or hard of hearing in STEM occupations and those not in STEM occupations by educational level.



Source: 2008 ACS Public use data sample. Table constructed using Data Ferret.

Figure 17. Degree levels for hearing and deaf or hard of hearing persons employed in selected STEM technician occupations.



Source: 2008 ACS Public use data sample. Table constructed using Data Ferret.

Conclusions

Beginning with passage of legislation creating the National Technical Institute for the Deaf in the mid sixties, to Section 504 of the Vocational Rehabilitation Act in 1973 which legislated equal access for disabled persons to postsecondary education, to the Americans with Disabilities Act of 1990 which extended access to all aspects of American life, the past 40 years have seen unprecedented growth in postsecondary opportunities for persons who are deaf or hard of hearing. Efforts at the state and federal levels in support of these acts have taken a variety of forms, including financial support for the elaborate network of community colleges and expanded state university systems. In addition, increased financial aid to students has improved access, while contributing to the ability to choose one's school. Also, there has been tremendous growth in the creation of offices to coordinate services for disabled students on most college campuses.

Despite the legislation described above, there remain significant issues for individuals who are deaf or hard of hearing when accessing many aspects of campus life. While admission to postsecondary education significantly increased over the period with about 60 percent of deaf and hard-of-hearing high school graduates now enrolling in some form of post high school education, only 23 percent of 25–64 year old persons who are deaf or hard of hearing have graduated from college. This compares to 38 percent for persons who are hearing (ACS, 2008). This lower proportion of college graduates is probably the result of the relatively poor academic preparation for large numbers of high school graduates who are deaf or hard of hearing.

Despite the legislation to improve access of K through 12 disabled students to mainstream education opportunities since the mid 1970's, results from NLTS2 testing indicate that the majority of high school students who are deaf or hard of hearing with IEP's continue to read at or below the fourth grade level. Allen (1994) reports that:

> "between 1983 and 1990 only slight gains in median achievement levels of deaf students aged 17 and 18 have been reported (Allen, 1986; Holt, 1993). In both years, approximately half of the deaf and hard-of-hearing students leaving special education programs did so reading below the fourth grade level."

In addition, students who are deaf or hard of hearing take fewer advanced mathematics courses in high school than do their hearing peers. This overall lower achievement is probably one explanation why more students who are deaf or hard of hearing enroll in two-year colleges than do hearing high school graduates.

Graduation from college results in major economic benefits for deaf or hard-of-hearing persons when compared with their peers who do not have a college degree. For those reporting earnings, college graduates earned, in 2007, 2.3 times more than non-college graduates: $40,522 compared to $17,448 for non graduates. The higher the postsecondary degree achieved by persons who are deaf or hard of hearing, the lower the unemployment rate, and more like the rates experienced by hearing persons. The increased employment rates and subsequent increased earnings for graduates translates into increased contributions to government treasuries by way of additional taxes. In addition, it reduces the dependence of these individuals on government welfare to sustain a minimum standard of living.

While graduation from college has significant economic benefits, graduation appears to do little to decrease the proportional gap between the earnings of workers who are deaf or hard of hearing and those who are hearing. For individuals without a college degree, workers who are deaf or hard of hearing earn 71 percent of hearing workers. For those with a college degree, workers who are deaf or hard of hearing earn 76 percent of hearing college graduates, only a modest reduction in the earnings gap.

The economic benefits of being employed in STEM occupations are significant for persons who are deaf or hard of hearing. Overall, persons who are deaf or hard of hearing who are employed in STEM occupations earn 31 percent more than persons who are deaf or hard of hearing not employed in STEM occupations. In addition to earning more than non-STEM workers, STEM workers with a college degree who are deaf or hard of hearing have earnings that average, 87 percent of the earnings of STEM workers who are hearing. Thus education in a STEM field and employment in a STEM job has the effect of decreasing the earnings gap between workers who are deaf or hard of hearing and hearing workers with similar degrees.

Finally, the reader should not consider the economic gains reported here as the only outcome from a college education. Research has demonstrated that college has other valuable outcomes such as a better informed citizenry, a more creative employee, and

one who is more committed to their job and their employer. Witmer (1978) eloquently states this caution:

> *And anyone who invests in higher education merely to realize a monetary return will have missed the central point that the products of higher education – which are as varied as the students and their programs of study – promote the general welfare through the development of whole persons to the limit of their capacities. Monetary rates of return merely indicate market valuation of some of the resultant products in the world of work, which almost never match the valuation of any one person."* (p. 57)

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National Technical Institute for the Deaf
Rochester Institute of Technology
Funded by the National Science Foundation,
Award Numbers HRD-0927586 and DUE-0903167.