2
Academic Achievement of Deaf Students

Ross E. Mitchell

The National Research Council (2001) identifies the practice of educational assessment as that which "seeks to determine how well students are learning and is an integral part of the quest for improved education. It provides feedback to students, educators, parents, policymakers, and the public about the effectiveness of educational services" (p. 1). Especially relevant to assessing the academic achievement of deaf students, this perspective assumes that the scores attained on standardized tests of academic achievement are valid and reliable indicators of what these students have learned; that the assessment results allow students as well as their families, teachers, and other interested parties to recognize their strengths and weaknesses; and that by identifying these strengths and weaknesses, families and schools have information that assists in designing and implementing programs and services that may improve the academic performance of these deaf students.

The latest reauthorizations of the two major federal education laws, namely, the No Child Left Behind Act of 2001 (hereafter NCLB) and the Individuals With Disabilities Education Improvement Act of 2004 (hereafter IDEA 2004), substantially incorporate the National Research Council's views on assessment.[1] That is, in addition to mandating a regime for school-based accountability that depends on the results of student test performance, current federal law encourages high-quality assessment practices that would provide detailed information about student academic performance and would be valuable for planning instruction and educational programming.

ACADEMIC ACHIEVEMENT RECORD

Two recent national studies provide important updates on the performance of deaf students on standardized assessments of academic achievement. The Gallaudet Research Institute established national norms for deaf and hard of hearing student performance on the Stanford Achievement Test Series, 10th edition (the National Deaf and Hard of Hearing Student Norms Project is described in Gallaudet Research Institute, 2004; Mitchell, Qi, & Traxler, 2008, in press), the fifth such study undertaken by the Gallaudet Research Institute over the last four decades (see also, e.g., Allen, 1986; Holt, Traxler, & Allen, 1992, 1997; Office of

1. For example, NCLB §1001.1; NCLB §§1111.b.3.C.ii, iii, xii, xv; and IDEA 2004 §614.b.3.A.

Demographic Studies, 1969; Traxler, 2000). At about the same time, SRI International conducted a similar study of deaf students' academic achievement as part of a comprehensive evaluation of the Individuals With Disabilities Education Act Amendments of 1997 (hereafter IDEA 1997) overseen by the Office of Special Education Programs (OSEP) within the U.S. Department of Education (e.g., see Blackorby et al., 2005; Wagner et al., 2003; Wagner, Newman, Cameto, & Levine, 2006; focusing solely on students with hearing impairment, see Blackorby & Knokey, 2006). These two studies are not identical in design, nor do they report achievement results from the same assessment instrument, but they are complementary. Together, the results of these studies highlight serious concerns about the academic achievement levels of deaf students.

Before presenting mathematics and reading achievement profiles for deaf students from the Gallaudet Research Institute and OSEP studies, two critical design differences need to be highlighted. First, the OSEP study did not specifically sample schools that enrolled students with hearing impairments (the applicable IDEA classification) whereas the Gallaudet Research Institute study used for its sampling frame a limited registry of schools and programs known to be serving deaf students. The consequence of this difference is that the Gallaudet Research Institute study is likely to overrepresent (a) deaf students with more severe hearing loss and (b) deaf students who attend schools for the deaf and other special programs that have relatively large numbers of deaf students (for a description of biases in the Gallaudet Research Institute study sampling frame, see Mitchell, 2004). Another way to look at this difference is that the OSEP study is likely to have a greater proportion of students who are hard of hearing compared with the Gallaudet Research Institute study. These prevalence differences between the two studies in severity of hearing loss and instructional program setting placement mean that achievement levels are expected to be higher for the OSEP study participants than for those in the Gallaudet Research Institute study (for a discussion of the relationship between achievement and deaf students' characteristics, see Karchmer & Mitchell, 2003).

Second, the OSEP study is longitudinal in its design whereas the Gallaudet Research Institute study is cross-sectional. As a result, except for replacements recruited because of attrition, the OSEP study is focused on a specific cohort of students identified for special education in 2000 regardless of their current eligibility for special education whereas the Gallaudet Research Institute study pertains to students tested in 2003, including students who were not identified until after 2000, had not entered the country until after 2000, or possibly had not become deaf until after 2000, but not including students who had exited special education before 2003. Moreover, the data from the OSEP study analyzed here are those collected during the second wave of data collection, which was closest in time to the Gallaudet Research Institute data collection activity. Because of study attrition and the difficulty of recruiting replacements, the achievement levels measured in the OSEP study are likely to be higher because, on average, more high-performing students remain in longitudinal studies. The cross-sectional Gallaudet Research Institute study is more likely to capture low-performing and mobile students. Despite these two important study design differences, certainly, there is significant overlap between the two study populations and, possibly, even identical participants. Nonetheless, there is no reason to expect the results of these studies to be identical.

Another important difference to highlight before presenting data summaries from the OSEP and Gallaudet Research Institute studies is that of the assessment instruments. The OSEP study used the Woodcock-Johnson III, which provides age-based norms. That is, the performance distribution is referenced to the age of the child taking the test batteries, not the child's grade in school. However, the Gallaudet Research Institute study used the Stanford Achievement Test Series, which provides grade-based norms. One has to assume an age-grade correlation to work with grade-based norms. In other words, Grade 2 norms are used for 8-year-olds, Grade 3 for 9-year-olds, Grade 4 for 10-year-olds, etc. With this very strong correlation, age-grade-based norms can then be used to compare the two groups of students on the two tests. The metric being used is the percentile rank collapsed into quartiles (i.e., 1st quartile is 1st–25th percentile, 2nd quartile is 26th–50th percentile, 2nd quartile is 51st–75th percentile, and 4th quartile is 76th–99th percentile).

OSEP Study

Two named studies within OSEP's IDEA 1997 evaluation measured academic achievement among deaf students identified for special education: the Special Education Elementary Longitudinal Study (SEELS) and the National Longitudinal Transition Study-2 (NLTS-2). Independent analyses of data from SEELS are summarized here. Data from the NLTS-2, which captures the high school age population and follows it beyond graduation, are not analyzed here, but published reports are summarized below. Analysis of data from the second wave of SEELS, which were collected in 2002, is reported here because the data were collected up to within a year preceding the Gallaudet Research Institute study and because the students were at the right ages for comparison purposes (i.e., at least age 8 years, specifically, ages 8 to 15 years).[2] The distributions of mathematics and reading achievement among these students with hearing impairment who were participating in SEELS in 2002 are summarized in Figure 2.1.

Each vertical bar in Figure 2.1 has four stacked segments, which represent the proportion of students whose scores correspond to each of the four quartiles of the general (hearing) population norms. If the score distribution of the deaf student population (more precisely, population of students with hearing impairment) were identical to the score distribution of the general population, then each of the four stacked segments would be exactly the same size, breaking at 25%, 50%, and 75% of students tested. However, the distributions differ dramatically. For

2. The data analyses reported here were run using *SPSS Complex Samples 15.0 for Windows* (SPSS, 2007) with the February 2007 release of the SEELS Waves 1, 2, and 3 public-use data file (U.S. Department of Education, 2007), Wave 2 data only. Analyses of the same data by SRI International were reported by Blackorby and Knokey (2006).

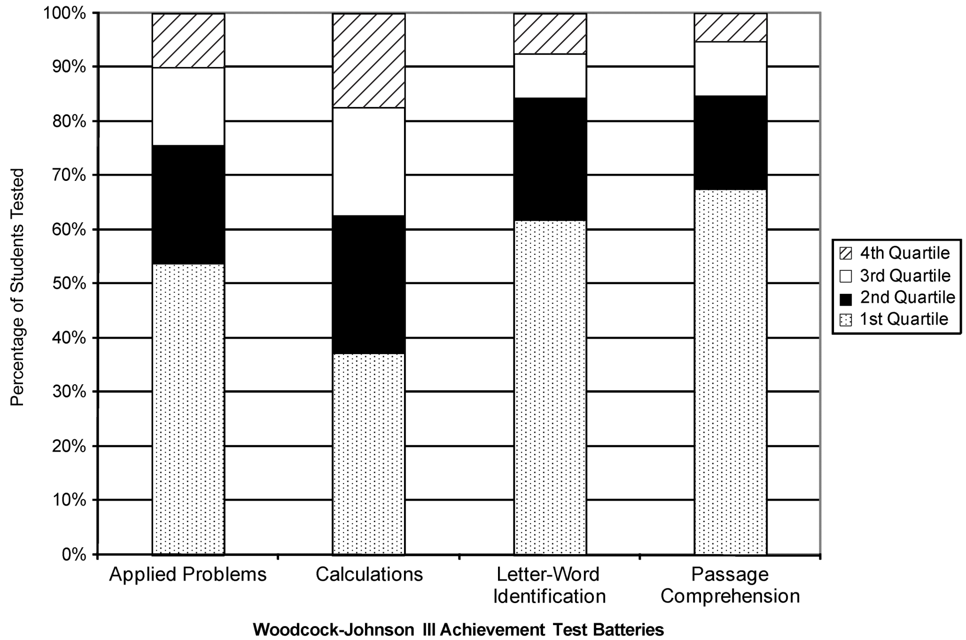

Figure 2.1. Distribution of mathematics and reading achievement among students with hearing impairment, ages 8–15 years, age-based general population norms, 2002. *Note:* From Special Education Elementary Longitudinal Study (U.S. Department of Education, 2007).

example, consider the first bar on the left, which is for the Applied Problems mathematics test. Nearly 54% of deaf students attained scores that corresponded to the lowest quartile of the general population (the lightly stippled white segment that is bounded at 0% and roughly 54%), which is more than twice what would have been expected if the two groups had similar achievement distributions. More than 75% of deaf students scored below the median of the general population (i.e., almost 22% scored in the 2nd quartile of the general population, represented by the solid black segment). Almost exactly 90% of deaf students scored in the first three quartiles of the general population distribution (i.e., almost 15% scored in the 3rd quartile of the general population, represented by the solid white segment). Only 10% of deaf students scored in the 4th quartile of the general population distribution (the densely stippled black segment bounded at roughly 90% and 100%). The median is typically considered the mark for being exactly at grade level (the boundary between the solid black and solid white segments), which means that just less than 25% of deaf students achieved at or above grade level on the Applied Problems mathematics test.

On the other test of mathematics, Calculations, deaf students come closer to, but are not in alignment with, the general population distribution of scores. About 37% of deaf students score at or above grade level (i.e., above the general population median). A similar proportion attain scores corresponding to just the 1st quartile of the general population. On the reading tests, the performance profiles are furthest out of alignment with the general population. For both Letter-Word Identification and Passage Comprehension, less than 16% of deaf students scored above the general population median. Slightly less than two-thirds achieved in the 1st quartile of the general population on Letter-Word Identification, and slightly more than two-thirds are in the 1st quartile on Passage Comprehension. These measures demonstrate a dramatic "achievement gap" between deaf students and their nondisabled peers.

For high school age students in the NLTS-2, Wagner and colleagues (2003) report that, on average, deaf students were 3.6 grades below grade level on tests of reading and 3.0 grades below grade level on tests of mathematics at the time of their most recent assessment. Just less than 20% of these students scored within one grade of grade level or better in reading while nearly 33% scored at least five grades below grade level. Almost 22% of the NLTS-2 sample of deaf students scored within one grade of grade level or better in mathematics while nearly 23% scored at least five grades below grade level.

Gallaudet Research Institute Study

From the Gallaudet Research Institute study, the most current deaf and hard of hearing student national norms for tests of reading and mathematics on the Stanford Achievement Test Series (hereafter referred to as the Stanford) are summarized in Figure 2.2.[3] Again, consider the first bar on the left, which is for the test of mathematics problem solving. Slightly more than 82% of deaf students attained scores that corresponded to the lowest quartile of the general population, which is more than three times what would have been expected if the two groups had similar achievement distributions. About 90% of deaf students scored below the median (50th percentile) of the general population (i.e., 8% scored in the 2nd quartile). Nearly 97% of deaf students scored in the first three quartiles of the general population distribution (i.e., 6% scored in the 3rd quartile). Only 3% of deaf students scored in the 4th quartile of the general population distribution. The median is typically considered the mark for being exactly at grade level, which means that just less than 10% of deaf students achieved at grade level on the test of mathematics problem solving. As expected, compared with the OSEP study, the results of the Gallaudet Research Institute study paint a more dismal picture of deaf students' academic achievement.

On the other test of mathematics, Procedures, deaf students come closer to, but are still quite far from alignment with, the general population distribution of scores. Less than 15% of deaf students are achieving at or above grade level (i.e., above the general population median). Almost 72% are in the 1st quartile of the general population score distribution. The performance profiles for the tests of reading vocabulary and reading comprehension are more profoundly skewed than that observed for mathematics problem solving. Well less than 10% of deaf stu-

---

3. The data analyses reported here were run using *SPSS Complex Samples 15.0 for Windows* (SPSS, 2007) with the unpublished data from the Stanford Achievement Test, 10th Edition, National Deaf and Hard of Hearing Student Norms Project (Gallaudet Research Institute, 2003).

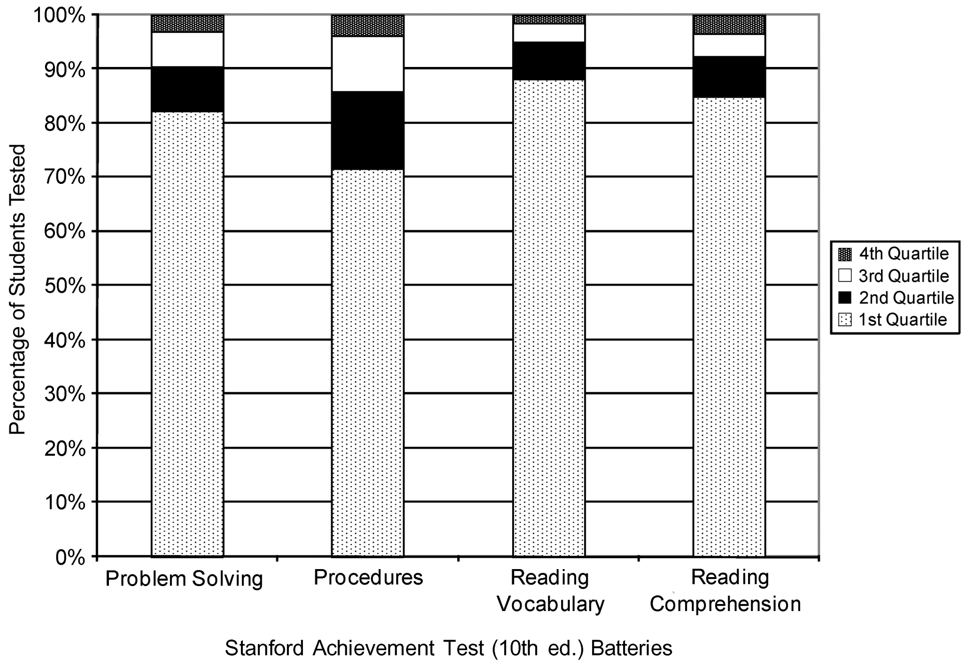

Figure 2.2. Distribution of mathematics and reading achievement among deaf students, ages 8–15 years, age-grade-based general population norms, 2003. *Note:* From National Deaf and Hard of Hearing Student Norms Project (Gallaudet Research Institute, 2003).

dents are at or above grade level on reading vocabulary and reading comprehension (less than 6% and 8%, respectively). Roughly seven of every eight students scores in the 1st quartile of the general population distribution (i.e., 88% on reading vocabulary and 85% on reading comprehension). The disparity between deaf students and their nondisabled peers is magnified by the selection biases of the Gallaudet Research Institute study. That is, by having a sample that amplifies the severity of disability and need for special programs, the Gallaudet Research Institute study emphasizes the dramatic achievement gap between this special population and the general population.

For high school age students taking the Stanford, on average, deaf students were 7.4 grades below grade level on tests of reading and 5.4 grades below grade level on tests of mathematics. Less than 10% of these students scored within 1.0 grade of grade level or better in reading while nearly 77% scored at least 5.0 grades below grade level. Almost 10% of the Gallaudet Research Institute study sample of deaf students scored within 1.0 grade of grade level or better in mathematics while nearly 53% scored at least 5.0 grades below grade level. Again, the sampling biases of the Gallaudet Research Institute sample draw attention to an even larger achievement gap between the general student population and deaf students with the greatest degrees of hearing loss or who are placed in programs designed to provide more specialized instructional services.

Historical Perspective

Putting these recent results into context, one can compare the current norms from the Gallaudet Research Institute study with those of deaf student performance on the Stanford over the last few decades. Karchmer and Mitchell (2003) note several studies that offer findings consistent with results from research using the Stanford; however, except for the Gallaudet Research Institute investigations using the Stanford, there are no other data that allow for historical comparison across multiple decades. Qi and Mitchell (2007) reviewed the distribution of scores relative to the general population and found that it has been nearly constant for both reading and mathematics. They found that performance in reading comprehension has held steady and has been quite low relative to the general population. The same is true for the type of content found on the current test of mathematics procedures. There are indications that there has been relative improvement in mathematics problem solving among older (high school age) deaf students since the 1990s, but part of the most recent (2003 norms for the 10th edition) improvement may be a consequence of eliminating an artificial ceiling in attainable scores that had been imposed on the design of earlier studies. In other words, the achievement gap between deaf students and the general population on the Stanford has remained large and effectively unchanged for more than three decades.

Another important historical perspective on the academic achievements of deaf students can be obtained by examining the two national longitudinal transition studies of special education students moving from their high school years to postsecondary education, employment, or other activities. These studies allow direct comparison among the groups of students identified by their disability categories. The relative performance of students with various disabilities can be assessed as well as any changes that have occurred over the intervening years. Explicit academic performance comparisons are made in a report by Wagner, Newman, and Cameto (2004) between the NLTS (data collected between 1985 and 1987) and NLTS-2 (data collected between 2001 and 2002) cohorts. These investigators found that "students with visual or hearing impairments tended to have the best grades overall, as well as among the largest increases over time in receiving mostly A's" (p. 4–8). Among students with disabilities, review of the NLTS and NLTS-2 studies leads to the conclusion that deaf students have been among the academically higher performing groups in both special education cohorts (though always exceeded by students with visual impairments) as measured by achievement testing (especially tests of mathematics), high school completion, and attendance at postsecondary educational institutions (National Research Council, 1997; Wagner et al., 2003; Wagner, Newman, Cameto, & Levine, 2005, 2006). That is, students with low-incidence disabilities have tended to outperform students identified by other, more prevalent primary disability categories. Moreover, students with low-incidence disabilities appear to have made tremendous gains among several indicators of academic achievement. However, this comparison is favorable only among students with disabilities. As discussed above, deaf students continue to lag far behind their nondisabled peers, especially on the recently elevated, if not decisive, indicator of academic achievement test scores.

CRITIQUE OF ASSESSMENT ASSUMPTIONS

Given the substantial achievement gap estimates from the OSEP and Gallaudet Research Institute studies, some discussion of assessment of deaf students is necessary. The accurate measurement of academic achievement depends on a number of considerations. In the case of deaf students, these considerations include important issues of language use and comprehension (see, e.g., Allen, White, & Karchmer, 1983; Baker, 1991; Chamberlain & Mayberry, 2000; Marschark, 2001; Paul & Quigley, 1990; Qi & Mitchell, 2007). Whether for the purpose of instructional feedback and program evaluation or punitive consequences of test-based accountability, accurately knowing what deaf students know presents a greater challenge than the demands placed on a system of assessment for their nondisabled, English-fluent peers.

As cited at the outset, the National Research Council (2001) emphasizes that educational assessment "seeks to determine how well students are learning." Elsewhere, however, the National Research Council (2004) highlights the challenges associated with testing students with disabilities and English language learners: "Many of these students have attributes—such as physical, emotional, or learning disabilities or limited fluency in English—that may prevent them from readily demonstrating what they know or can do on a test" (p. 1). In other words, when it comes to deaf students, test results may not accurately indicate how well they are learning. In a test-based accountability regime, this threat to validity undermines the entire enterprise. Unfortunately, "the existing base of research about the effects of accommodations on test performance and the comparability of scores obtained under standard and accommodated conditions is insufficient to provide empirical support for many of the decisions that must be made with respect to the testing of these students" (National Research Council, 2004, p. 2). There are some serious questions about just what causes the achievement gap identified in the recent Gallaudet Research Institute and OSEP studies and no unequivocal answers.

There are at least two clear directions for research that may lead to more accurate inferences from the assessment of academic achievement among deaf students. The first has nothing to do with test development, but has everything to do with valid inferences in a system of test-based school accountability. The first question raised by the National Research Council (2006, p. 145) for the purpose of examining systems for statewide assessment of science is whether any information is collected that establishes whether students have sufficient opportunity to learn. This question is an essential one, regardless of content area. Student attributes that may interfere with accurate assessment are not necessary to consider if the instructional program does not deliver the assessed content in a manner that can be learned.

Accommodating disabilities, including deafness, will not matter if the students do not or cannot know the material being tested. Given that federal special education law mandated access to the general curriculum only a decade ago, and many schools and programs serving students in special education did not take assessment participation seriously until after the passage of NCLB, a systematic approach to verifying adequate opportunity to learn would significantly improve the validity of inferences from statewide accountability assessments. If students do not have the opportunity to learn the content that an accountability exam attempts to assess (which assumes, correctly or not, that such exams can assess that learning) then results from such a test will provide little insight into what students actually have been learning in the classroom.

The second area for further research is language-based test accommodations (for an extended discussion of this topic, see Qi & Mitchell, 2007). For both students with disabilities and English language learners, “the assumption underlying the accommodation is that every student has a true level of competence in each tested subject area, and that a perfectly reliable and valid assessment will reveal that true performance. The accommodation is intended only to compensate for factors that prevent the student from demonstrating his or her true competence, and not to improve his or her performance beyond that level” (National Research Council, 2004, p. 35). In addition to being classified as one of several categories of students with disabilities, deaf students may be thought of, imperfectly, as English language learners because they may enter school either with prior proficiency in a signed language (see, e.g., Johnson, Liddell, & Erting, 1989; Meadow-Orlans, Mertens, & Sass-Lehrer, 2003; Mitchell & Karchmer, 2005; Mitchell, Young, Bachleda, & Karchmer, 2006; Padden & Humphries, 1988) or with delays in learning any language (see, e.g., Emmorey, Bellugi, Frederici, & Horn, 1995; Mayberry & Lock, 1998; Morford & Mayberry, 2000). Regardless of either the specific languages acquired or the timing of their acquisition, deaf students have limited access to spoken English language environments and receive instructional accommodations that do not depend on spoken English (e.g., teachers may interact with students directly through American Sign Language or through an interpreter using American Sign Language or some system of manual communication representing English). Typically, this limited access to spoken English negatively affects deaf students’ abilities to respond effectively to written English tests.

Systematic investigation of tests that offer language simplification or translation into the discourse mode of the classroom would determine the efficacy of these accommodations and help eliminate any confoundedness between access to the assessment and other possible explanations of poor test performance (such as opportunity to learn). In other words, the assumption that students fully understand (a) the tasks they are asked to perform and (b) the nature of the responses requested is not necessarily a safe one. Appropriate language-based accommodations would improve the validity of inferences about learning by deaf students.

Without answers to questions of opportunity to learn and the efficacy of test accommodations, the National Research Council’s (2001) remaining ambitions for educational assessment cannot be achieved with deaf students. In other words, validity and reliability remain to be determined; identifying students’ strengths and weaknesses is more difficult; and feedback to program design and implementation, not to mention stakeholders (i.e., students, educators, parents, policymakers, and the public) will be more equivocal. Until high-quality assessment practices are brought to deaf education, it is going to be difficult to know what deaf students know. Or, at a minimum, schools serving deaf students will have great difficulty being responsive to a system of test-based accountability.

CONCLUSION

Current standardized assessment results indicate that there is a large achievement gap between deaf students and their nondisabled peers. This disparity has existed for decades and has changed little if at all. At the same time, performance indicators from other measures of academic achievement would suggest that deaf students are more successful in school and have translated that success into greater postsecondary education and employment opportunities. Either more deaf students are receiving inflated grades and easy passes to graduation and postsecondary opportunities or standardized assessments are failing to accurately measure the improved academic achievements of deaf students.

As discussed in this chapter's brief critique of assessment assumptions, there is good reason to believe that current standardized assessment practices may result in low-quality information about deaf students' learning, though the degree of disconnect between what deaf students know and their performance on tests of academic achievement is uncertain. Certainly, many students with low scores would continue to perform poorly even with appropriate accommodations because delayed language development or insufficient opportunity to learn have interfered with their ability to know the material being tested. Many other deaf students, however, may in fact know more than their test performances reveal. Valid inferences based on the test scores of students who have developed their academic proficiency through signed language rather than English language discourse are limited by the use of written English tests.

In the current era of test-based accountability, especially with the NCLB mandate that *all* students achieve proficient status on statewide accountability assessments by 2014, there is great reason to be concerned. Without some dramatic intervention that transforms the achievement profile of deaf students, eventually, these and others students in special education are likely to prevent schools from achieving 100% proficiency. Even with special allowances for students with severe cognitive disabilities (which is a category that applies to some but not all deaf students) and narrowing of the domain for which students will be held accountable for a larger share of students in special education, tremendous change is needed before all remaining deaf students achieve at the proficient level. Given the findings from the national longitudinal transition studies showing that significant progress has been made with deaf students over the last two decades, the central and elevated importance of performance on standardized tests of academic achievement is quite troubling. And though there is room for advancing the opportunity to learn, without fair and balanced consideration of multiple indicators of academic achievement, it is unclear whether test quality, assessment practices, and student performance will improve in time to prevent serious and potentially harmful disruption to the education of deaf students.

REFERENCES

Allen, T. E. (1986). Patterns of academic achievement among hearing impaired students: 1974 and 1983. In A. N. Schildroth & M. A. Karchmer (Eds.), *Deaf children in America* (pp.161–206). San Diego, CA: College-Hill Press.

Allen, T. E., White, C. S., & Karchmer, M. A. (1983). Issues in the development of a special edition for hearing-impaired students of the seventh edition of the Stanford Achievement Test. *American Annals of the Deaf, 128* (1), 34–39.

Baker, R. M. (1991). Evaluation of hearing-impaired children. In K. E. Green (Ed.), *Educational testing: Issues and applications* (pp. 77–107). New York: Garland.

Blackorby, J., & Knokey, A.-M. (2006). *A national profile of students with hearing impairments in elementary and middle school: A special topic report from the Special Education Elementary Longitudinal Study.* Menlo Park, CA: SRI International.

Blackorby, J., Wagner, M., Cameto, R., Davies, E., Levine, P., Newman, L., et al. (2005). *Engagement, academics, social adjustment, and independence: The achievements of elementary and middle school students with disabilities.* Menlo Park, CA: SRI International.

Chamberlain, C., & Mayberry, R. I. (2000). Theorizing about the relation between American Sign Language and reading. In C. Chamberlain, J. P. Morford, & R. I. Mayberry (Eds.), *Language acquisition by eye.* (pp. 221–259). Mahwah, NJ: Lawrence Erlbaum.

Emmorey, K., Bellugi, U., Frederici, A., & Horn, P. (1995). Effects of age of acquisition on grammatical sensitivity: Evidence from on-line and off-line tasks. *Applied Psycholinguistics, 16,* 1–23.

Gallaudet Research Institute. (2003). Stanford Achievement Test, 10th Edition, National Deaf and Hard of Hearing Student Norms Project, non-public data file. Washington, DC: Gallaudet Research Institute, Gallaudet University.

Gallaudet Research Institute. (2004). *Norms booklet for deaf and hard-of-hearing students: Stanford Achievement Test, 10th Edition, Form A.* Washington, DC: Gallaudet University.

Holt, J. A., Traxler, C. B., & Allen, T. E. (1992). *Interpreting the scores: A user's guide to the 8th Edition Stanford Achievement Test for educators of deaf and hard of hearing students.* (Gallaudet Research Institute Technical Report No. 92-1). Washington, DC: Gallaudet University.

Holt, J. A., Traxler, C. B., & Allen, T. E. (1997). *Interpreting the scores: A user's guide to the 9th Edition Stanford Achievement Test for educators of deaf and hard-of-hearing students.* (Technical Report No. 97-1). Washington, DC: Gallaudet University, Gallaudet Research Institute.

Individuals With Disabilities Education Act Amendments of 1997, Pub. L. No. 105-17, 20 U.S.C. § 1400 *et seq.*

Individuals With Disabilities Education Improvement Act of 2004, Pub. L. No. 108-446, 20 U.S.C. § 1400 *et seq.*

Johnson, R. E., Liddell, S. K., & Erting, C. J. (1989). *Unlocking the curriculum: Principles for achieving access in deaf education.* (Working Paper No. 89-3). Washington, DC: Gallaudet Research Institute, Gallaudet University.

Karchmer, M. A. & Mitchell, R. E. (2003). Demographic and achievement characteristics of deaf and hard of hearing students. In M. Marschark & P. E. Spencer (Eds.), *Oxford* *handbook of deaf studies, language, and education,* (pp. 21–37). New York: Oxford University Press.

Marschark, M. (2001). *Language development in children who are deaf: A research synthesis*. Alexandria, VA: National Association of State Directors of Special Education. (ERIC Document Reproduction Service No. ED455620)

Mayberry, R. I., & Lock, E. (1998, May). *Critical period effects on grammatical processing: Privileged status of the first language.* Paper presented at the American Psychological Society Convention, Washington, DC.

Meadow-Orlans, K. P., Mertens, D. M., & Sass-Lehrer, M. A. (2003). *Parents and their deaf children: The early years.* Washington, DC: Gallaudet University Press.

Mitchell, R. E. (2004). National profile of deaf and hard of hearing students in special education from weighted survey results. *American Annals of the Deaf, 149* (4), 336–349.

Mitchell, R. E., & Karchmer, M. A. (2005). Parental hearing status and signing among deaf and hard-of-hearing students. *Sign Language Studies, 5* (2), 83–96.

Mitchell, R. E., Qi, S., & Traxler, C. B. (2008, in press). *Stanford Achievement Test, 10th Edition, national performance norms for deaf and hard of hearing students: A technical report.* Washington, DC: Gallaudet Research Institute, Gallaudet University.

Mitchell, R. E., Young, T. A., Bachleda, B., & Karchmer, M. A. (2006). How many people use ASL in the United States? Why estimates need updating. *Sign Language Studies, 6* (3), 306–335.

Morford, J. P., & Mayberry, R. I. (2000). A reexamination of "early exposure" and its implications for language acquisition by eye. In C. Chamberlain, J. P. Morford, & R. I. Mayberry (Eds.), *Language acquisition by eye,* (pp. 111–127). Mahwah, NJ: Lawrence Erlbaum.

National Research Council. (1997). *Educating one and all: Students with disabilities and standards-based reform.* L. M. McDonnell, M. J. McLaughlin, & P. Morison (Eds.), Committee on Goals 2000 and the Inclusion of Students with Disabilities, Board on Testing and Assessment, Commission on Behavioral and Social Sciences and Education. Washington, DC: National Academies Press.

National Research Council. (2001). *Knowing what students know: The science and design of educational assessment.* Committee on the Foundations of Assessment, J. Pelligrino, N. Chudowsky, & R. Glaser (Eds.), Board on Testing and Assessment, Center for Education. Division of Behavioral and Social Sciences and Education. Washington, DC: National Academies Press.

National Research Council. (2004). *Keeping score for all: The effects of inclusion and accommodation policies on large-scale educational assessments.* Committee on Participation of English Language Learners and Students with Disabilities in NAEP and Other Large-Scale Assessments, J. A. Koenig & L. F. Bachman (Eds.), Board on Testing and Assessment, Center for Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

National Research Council. (2006). *Systems for state science assessment.* Committee on Test Design for K–12 Science Achievement, M. R. Wilson and M. W. Bertenthal (Eds.), Board on Testing and Assessment, Center for Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

No Child Left Behind Act of 2001, Pub. L. No. 107-110, 115 Stat. 1425 (2002).

Office of Demographic Studies. (1969). *Academic achievement test performance of hearing impaired students.* Washington, DC: Gallaudet College.

Padden, C. A., & Humphries, T. (1988). *Deaf in America: Voices from a culture.* Cambridge, MA: Harvard University Press.

Paul, P. V., & Quigley, S. P. (1990). *Education and deafness.* New York: Longman.

Qi, S., & Mitchell, R. E. (2007, April 10). *Large-scale academic achievement testing of deaf and hard-of-hearing students: Past, present, and future.* Paper presented at the annual meeting of the American Educational Research Association, Chicago, Illinois.

Traxler, C. B. (2000). The Stanford Achievement Test, 9th Edition: National norming and performance standards for deaf and hard-of-hearing students. *Journal of Deaf Studies & Deaf Education, 5* (4), 337–348.

U.S. Department of Education. (2007, February). Special Education Elementary Longitudinal Study, Waves 1, 2, and 3 public-use data file. Washington, DC: Office of Special Education Programs, U.S. Department of Education.

Wagner, M., Marder, C., Blackorby, J., Cameto, R., Newman, L., Levine, P., et al. (2003). *The achievements of youth with disabilities during secondary school. A report from the National Longitudinal Transition Study-2 (NLTS2).* Menlo Park, CA: SRI International.

Wagner, M., Newman, L., & Cameto, R. (2004). *Changes over time in the secondary school programs of students with disabilities. A report of findings from the National Longitudinal Transition Study and the National Longitudinal Transition Study-2 (NLTS2).* Menlo Park, CA: SRI International.

Wagner, M., Newman, L., Cameto, R., & Levine, P. (2005). *Changes over time in the early postschool outcomes of youth with disabilities. A report of findings from the National Longitudinal Transition Study (NLTS) and the National Longitudinal Transition Study-2 (NLTS2).* Menlo Park, CA: SRI International.

Wagner, M., Newman, L., Cameto, R., & Levine, P. (2006). *The academic achievement and functional performance of youth with disabilities. A report from the National Longitudinal Transition Study-2 (NLTS2).* (NCSER 2006-3000). Menlo Park, CA: SRI International.