College and Career Readiness: Course Taking of Deaf and Hard-of-Hearing Secondary School Students

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Abstract

As schools work to raise the number of students who leave secondary school ready for college and career by increasing both the number of academic courses required and the overall rigor of the curriculum, they must ensure that students with disabilities, including those who are deaf or hard of hearing (DHH), are not left behind. They can do this by equipping such students with the academic knowledge and noncognitive skills to fulfill their individual potential, compete with other workers, and lead full and independent lives. The present study, drawing on nationally-representative sample of approximately 610 DHH students from the National Longitudinal Transition Study-2 (NLTS2) dataset,, was designed to focus on DHH students' college and career readiness by investigating their opportunities to acquire college and career skills, operationalized in this study as courses taken in secondary school. We examined how DHH students' course taking compared with that of their peers in the general population, how it varied by type of secondary school, and how it varied by instructional setting for DHH students educated in regular schools. All statistics were weighted to be representative of the larger population of secondary school–age DHH students identified for special education services under the hearing impairment category. Findings from descriptive analyses indicated that DHH students earned more credits overall than their hearing peers and both groups earned a similar number of credits in academic courses. However, DHH students took more vocational and nonacademic courses and fewer courses in science, social science, and foreign languages than their hearing peers. There was evidence that DHH students' academic courses in math lacked the rigor of those taken by hearing peers as DHH students earned more credits in basic math and fewer credits in midlevel math courses and even fewer in advanced math courses than hearing

peers. The lack of exposure to midlevel and advanced math places DHH students' futures at risk given the link between rigorous math and success in college and careers. The findings that DHH students earned fewer credits in science, social studies, and midlevel and advanced math relative to the general population and that DHH students in regular schools earned more credits in those areas than their DHH peers in special schools also raises the question of opportunities to learn and academic achievement in these areas. (Contains 5 tables).

College and Career Readiness: Course Taking of Deaf and Hard-of-Hearing Secondary School Students

Although extensive information is available on the education of deaf and hard of hearing (DHH) students throughout their school years and into college, far less information exists about their career and college readiness or how school experiences influence their subsequent development, growth, and success in college and the workplace (Kelly, 2015). Studies have shown that, compared with their hearing peers, DHH students frequently enter secondary school, college, and the workplace relatively unprepared for success (Kelly, 2015; Marschark, Shaver, Nagle, & Newman, 2015). In particular, DHH students' reading comprehension, math, and science skills are generally several grade levels below those of hearing students. If DHH secondary school students are lagging significantly behind hearing peers in reading, math, and science (Marschark et al., 2015; Qi & Mitchell, 2012), how college or career ready can they be?

In an effort to better understand the influence of secondary school preparation on college and career readiness, we used a national database of secondary school–age DHH students to examine how their course taking matched expectations for students in the general population and how it varied by enrollment in regular or special education settings. Clearly, other factors, such as family attitude toward education, family involvement in students' school activities, and geographic stability, also have an impact on college and career readiness (ACT, 2007). However, one of the strongest predictors of success in college and the workforce is course selection (ACT, 2004, 2006; Robbins et al., 2004). For this reason, we looked at the academic and the nonacademic course selections of DHH students. By *academic courses* we mean the core courses of mathematics, language arts, science, social studies, and foreign language that are taught in high school that form the content knowledge base required for success at higher levels. By *nonacademic courses* we mean academic discipline and self-confidence, communication skills,

study skills, goal striving, and emotional control (ACT, 2007; Robbins et al., 2004), which are covered in nonacademic courses in high school.

Throughout the 20th century, high school graduates faced a fork in the road. One path led to a 4-year college, the other to an entry-level job (Spring, 1997). In the 21st-century global economy, the choices are much more complex and interconnected, and there are multiple paths, all of which require a rigorous and rich high school experience that prepares all students—not just some—for college and a career (Achieve and the National Association of State Directors of Career and Technical Educational Consortium, 2014; Career Readiness Partner Council, n.d.; Southern Regional Education Board, 2013).

Researchers, policymakers, and other stakeholders have made numerous attempts to define what it means to be college and career ready, and recently a consensus emerged (Conforti, 2013): Being *college ready* means being prepared to enter and succeed in any postsecondary education or training experience that leads to a postsecondary credential (i.e., a certificate, license, or associate's or bachelor's degree). Therefore, students should have access in high school to a range of academic courses with the appropriate level of challenge and complexity (especially in literacy and numeracy) and the learning skills (e.g., high-order critical thinking, ability to write clearly and analytically, and problem-solving skills) and nonacademic skills (e.g., motivation, tenacity, knowledge of how to apply to college and obtain financial support) necessary for postsecondary success (Achieve, 2012; Conley, 2012; Southern Regional Education Board, 2013). Being *career ready* means possessing the academic skills that employees need to be successful and the technical skills (those necessary for a specific job function) and 21st-century employability skills (e.g., interpersonal skills, creativity and innovation, a work ethic and personal responsibility, global and social awareness) that are

necessary for entry into a successful career (Achieve, 2012; Conley, 2012). Therefore, students should have access in high school to a broad range of academic subjects grounded in rigorous internationally benchmarked state standards, as well as content in technical topic areas. In addition, high school programs should enable students to have a good understanding of their interests, talents, and weaknesses, and a solid grasp of the skills and dispositions necessary for engaging in today's fast-paced global economy (Career Readiness Partner Council, n.d.).

Ensuring that all students graduate from secondary school on time and ready for college and careers has become a key priority for the education community, policymakers, and business and industry leaders (Achieve, 2013; Porter & Polikoff, 2012: U.S. Department of Education, 2010). At the national level, having a college- and career-ready workforce makes the country more productive and more globally competitive (Bernanke, 2007). At the individual level, being college and career ready enables a person to compete for jobs that will provide a family-sustaining wage and pathways to advancement (Association for Career and Technical Education, 2010; Council on Competitiveness, 2007; Hooker & Brand, 2009; U.S. Department of Labor, 2007). Unfortunately, considerable evidence indicates that many secondary school graduates in the United States are not college and career ready. It was found that only 31% of all 2012 high school graduates who took the ACT, a national college admissions examination, were academically ready for college course work in science, only 46% were academically ready for college course work in math, and only 25% were academically ready for college course work in all four core ACT areas: English, reading, math, and science (ACT, 2012). Additionally, the Business Roundtable (n.d.) has reported that, in response to a recent survey, more than 95% of member CEOs indicated that their companies suffered from skills shortages, and expressed

support for the idea that closing the gap between the skills employers need and those that workers possess is a national imperative.

There is little doubt that joining today's modern workforce is a complex endeavor for any student, and even more so for DHH students. Research has shown that any degree of hearing loss, regardless of severity or the presence of other disabilities, puts students at risk for poor academic achievement (e.g., Blanchfield, Feldman, Dunbar, & Gardner, 2001; Goldberg & Richburg, 2004; Moeller, Tomblin, Yoshinaga-Itano, Connor, & Jerger, 2007). In particular, literacy rates among DHH students are significantly lower than among the general population (Marschark et al., 2015; Qi & Mitchell, 2012). Kelly (2015) has noted, for example, that by age 18 years only about 50% of DHH students have achieved reading comprehension at the fourth-grade level or above. Historically, DHH adults have faced career difficulties: They have higher unemployment rates than adults in the general population (Walter & Dirmyer, 2012), they are overrepresented in the fastest-declining occupations (Kruse, Schur, & Ali, 2010), and they earn less than hearing adults with comparable levels of educational attainment (Schley et al., 2011). In addition, large numbers of DHH adults receive Supplemental Security Disability Insurance and are not engaged in work or education (Clarcq & Walter, 1998; Weathers et al., 2007). Clearly, much work remains to be done to help DHH students attain the knowledge and skills they need to be successful in college and the workplace (Kelly, 2015).</>

Trends in the Education of DHH Students

Since passage of the Education for All Handicapped Children Act of 1975 (P.L. 94-142) and its subsequent reauthorizations as the Individuals With Disabilities Education Act (IDEA), the type of school DHH students attend has changed dramatically. In the mid-20th century, about 80% of DHH children in the United States attended separate, frequently residential schools for

the deaf (Lane, Hoffmeister, & Bahan, 1996). Now, more than 80% of DHH students spend all or part of the school day in regular public schools (U.S. Department of Education, 2014). Recent findings from the nationally representative, large-scale National Longitudinal Transition Study–2 (NLTS2) indicate that DHH secondary students enrolled in regular and special schools in the United States do not differ significantly in race/ethnicity, socioeconomic factors, the presence of additional disabilities, or other demographic characteristics (Shaver, Marschark, Newman, & Marder, 2014). Shaver et al. (2014) found that the primary differences were that DHH students in regular secondary schools were more likely to have mild or moderate levels of hearing loss and to use spoken language than students in special schools, who were more likely to have severe to profound hearing losses and use sign language (Allen & Anderson, 2010).

The settings where DHH students in regular high schools receive instruction also have changed. The percentage of DHH students receiving any of their instruction in a special education setting has decreased considerably. In 1987, 94% of DHH secondary students received instruction in a special education setting. By 2002, that figure had dropped 26 percentage points, to 68% (Wagner, Newman, & Cameto, 2004). In a reflection of the broader movement toward greater inclusion in general education settings, DHH students also experienced significant increases in the likelihood that their language arts, science, and social studies courses would be provided in general education settings (17–22 percentage points) and corresponding significant decreases in the likelihood that those courses would be in special education settings (18–20 percentage points; Wagner et al., 2004). In a contrast with the pattern for academic course taking, DHH students experienced significant decreases in the likelihood that their nonacademic classes, such as career and technical education courses and life skills courses, would be in general educational settings.

Toward College and Career Readiness

Secondary schools have a pivotal role to play in preparing students for adult life, and traditionally have offered a range of courses to prepare students, from academic to career and technical education to fine arts and physical education (Spring, 1997; U.S. Department of Education, Office of Vocational and Adult Education, 2003). However, institutions of higher education and the business community have expressed concerns about the inadequacy of a traditional high school education to prepare students for the postsecondary education or training necessary to enter career fields that will enable them to have higher wages and greater potential for growth (Alliance for Excellent Education, 2009; Carnevale, Smith, & Strohl, 2010). Momentum is growing in states to increase the academic rigor of the high school programs all students must take to graduate so they are better prepared for postsecondary education and the workplace (National High School Alliance, 2006). A large majority of states have increased the minimum years of instruction in academic content that students must take to earn credits toward a standard high school diploma. Buddin and Croft (2014) found that 27 U.S. states required at least 1 more year of math instruction and 19 states required an additional year of science for the high school graduation class of 2013 as compared with the class of 2006. States also have increased the rigor of courses required for graduation, particularly in math. In 2007, three states had requirements for 4 years of math that included Algebra II or its equivalent—courses that some argue are necessary if students are to be college and career ready. That number increased to 21 states by 2010 (Achieve, 2010).

Most recently, a number of U.S. states have implemented policies that align graduation requirements with the Common Core State Standards (CCSS; National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010) or with college admission standards. Nineteen states and the District of Columbia have elevated their high

school diploma requirements to a level commensurate with the CCSS College and Career Readiness standards (Achieve, 2013). This alignment brings together public education, postsecondary institutions (including 2- and 4-year colleges), technical schools, and employers to develop a shared understanding of postschool requirements and to develop initiatives to narrow the readiness gap between what students learn in high school and the skills they need to succeed in the workforce and attain technical certificates and postsecondary degrees (American Institutes for Research, 2013).

Rigorous, academically focused secondary school curricula have been linked to readiness for college and a career, as well as improved postschool outcomes. For example, such curricula have been found to contribute significantly to college enrollment, persistence, and completion of postsecondary education (Dougherty, Mellor, & Jian, 2006; Karp, Calcagno, Hughes, Jeong, & Bailey, 2007; Roderick, Nagaoka, & Coca, 2009; Rumberger & Larson, 1998; Wiley, Wyatt, & Camara, 2010). Adelman (1999, 2006) found that the academic content pursued during secondary school was an important predictor of college degree completion, even after other criteria of college success were controlled for. Long, Conger, and Iatarola (2012) found that students who took rigorous courses in secondary school were 5 to 6 percentage points more likely to enroll in college than students who did not. Furthermore, college students who took a rigorous course in nearly any subject earned more college credits and higher college grade point averages and were more likely to get a bachelor's degree. Math courses in particular are strong predictors of college completion. Adelman (2006) noted an increase in the percentage of students who earned bachelor's degrees for each year of math that students reported taking in secondary school, starting with pre-algebra and ending with calculus, with the greatest benefit to degree attainment being associated with taking courses beyond Algebra II. However, math and science

are two domains in which DHH students typically do not score as well as hearing peers in achievement testing (Kelly, 2008; Marschark et al., 2015; Qi & Mitchell, 2012).

Specific course-taking sequences have also been shown to be correlated with future success. For example, the completion of Algebra I in the eighth grade and Algebra II in the ninth grade is inversely correlated with the need for remediation at the postsecondary level (Klepfer & Hull, 2012; Lee, 2012, Musen, 2010). Several researchers have noted that early enrollment in algebra is particularly important because of algebra's gatekeeping function for further math and science study, postsecondary educational opportunities, and technically skilled jobs (Gamoran & Hannigan, 2000; Stein, Kaufmann, Sherman, & Hillen, 2011). F. G. Paul (2005) noted that not only did students who enrolled in algebra in eighth grade more often enroll in advanced math courses beyond Algebra II, but also were more likely to enroll in biology, chemistry, and physics courses in secondary school.

This focus on academic course taking and increased academic graduation requirements has other implications. The additional time spent in academic courses may limit the time students have in their schedules for career/technical education (CTE) courses (McLaughlin & Tilstone, 2000; Patton & Trainor, 2002) and other important nonacademic courses. For example, in the 15 years between 1987 and 2002, the rate of DHH students taking math, science, social studies, and foreign language courses increased significantly, but this resulted in a concurrent decrease in the rate of CTE and fine or performing arts course taking (Wagner et al., 2004).

CTE has evolved promisingly over the past several years, and research suggests that it can be an effective approach to helping students succeed in high school and beyond (American Institutes for Research, 2013). In a growing number of high schools, CTE is no longer just about teaching students a narrow set of skills sufficient for entry-level jobs; it is about preparing

students for careers. High-quality CTE can address the goals of college and career readiness as well as academic course work, and, importantly, provides learning options that appeal to students who might otherwise be at risk of leaving high school (Oakes & Saunders, 2008; Plank, DeLuca, & Estacion, 2005).

Educators, policymakers, and business and industry leaders point out that academic preparation on its own does not guarantee success in college and careers and that students must also develop other qualities and skills, known as *21st-century employability skills* or *noncognitive skills*. These include teamwork, workplace relations, motivation, independence, and self-advocacy (Achieve, 2013; Alwell & Cobb, 2007; Cobb, Lehmann, Newman-Gonchar, & Alwell, 2008; Conley, 2012; Wolgemuth, Cobb, & Dugan, 2006). The development of noncognitive skills is especially important for DHH students, who may need explicit instruction in some of these skill areas (Albertini, Kelly, & Matchett, 2011). Researchers emphasize the need for DHH students to participate in comprehensive career development programs during the school years to help them acquire and refine good work habits and good learning skills, learn about career opportunities, and make sound career decisions (Bullis, Davis, Bull, & Johnson, 1995; Danek & Busby, 1999; Hoyt, 1994; Luckner, 2002; Szymanski, Lutz, Shahan, & Gala, 2014). Many DHH students have limited experience with work and work-related activities on which to base informed career and life decisions. This lack of knowledge can lead to occupational stereotyping and limited aspirations (Schroedel, 1991). Integrated, career-focused learning activities may also include approaches for developing decision-making and problem-solving skills, job search skills, employability skills, interviewing skills, and résumé development (Albertini et al., 2011; Danek & Busby, 1999).</>

College and Career Outcomes of DHH Students

Significant progress has been made in DHH students' postschool outcomes in the last 25 years. Postsecondary education enrollment has improved steadily, suggesting some progress in DHH students' readiness for college entry. In a report comparing the postsecondary school outcomes and experiences of youth with disabilities in 1990 and 2005, Newman, Wagner, Cameto, Knokey, and Shaver (2010) reported significant progress for DHH students: an increase in overall enrollment in postsecondary education from 50% to 73%. This trend has continued, with Newman et al. (2011) reporting that 75% of DHH students continued to postsecondary education within 8 years of leaving secondary school. Although recent postsecondary enrollment rates for DHH students and their hearing peers are comparable, there is some debate over the graduation rate of DHH individuals. Marschark, Lang, and Albertini reported in 2002 that approximately 35% of DHH students graduated from 2-year programs and about 30% graduated from 4-year programs. By comparison, these students' hearing peers had graduation rates of approximately 40% and 70%, respectively. More recently, however, 53% of DHH students were reported to complete postsecondary school, earning a diploma or certificate from a 2- or 4-year college or a career and technical education school (Newman et al., 2011).

Employment rates for DHH young adults also improved between 1990 and 2005 (Newman et al., 2010). The employment rate for DHH students out of secondary school at the time of the 1990 interviews was 38%; by the time of the 2005 interviews, the rate had increased to 61%. Newman and colleagues (2011) found that by 2009 a large majority of DHH students, 92%, reported that they had been employed at some time since leaving secondary school, and that 57% said they were employed at the time they were interviewed. DHH young adults who had been out of secondary school for up to 8 years, however, worked significantly fewer hours

on average than their same-age peers in the general population (31 hours vs. 37 hours per week) and were less likely than their peers to receive health insurance from their employer (40% vs. 56%; Newman et al., 2011).

Despite promising trends, the persistent underemployment of DHH adults and their low postsecondary education completion rates suggest that much work remains to be done to prepare DHH students for college and careers. This is a critically important yet challenging charge. It requires that DHH students be offered and be able to take advantage of opportunities to learn—opportunities to acquire the knowledge, skills, and competencies to complete secondary school, earn a diploma, get access to postsecondary education, and/or secure a job with a sustaining wage offering pathways to advancement. Yet little is known nationally about the academic and career course-taking experiences of DHH secondary students that open doors to those opportunities.

Methods

Data Sources and Analytic Methodology

The study reported here used a national database of secondary school–age DHH students, the National Longitudinal Transition Study–2, to examine DHH students' course taking and how it varied by type of secondary school and instructional setting. NLTS2 is the largest dataset available for examination of the experiences of secondary school DHH students, and the only one that provides the basis to do so nationally.

NLTS2 was conducted by SRI International for the U.S. Department of Education. The NLTS2 sample included DHH students who met the following criteria as of December 1, 2000: age 13–16 years, enrolled in grade 7 or above, and identified by their school district as receiving special education services for a primary disability of "hearing impairment."[1] The NLTS2

sampling procedures involved first drawing a random sample of school districts that served students in the eligible age range stratified by region, the size of the local education authority (i.e., student enrollment), and community wealth. The second sampling stage entailed randomly selecting students receiving special education in each of the 12 special education disability categories from the rosters of participating local education authorities or special schools. Data were collected in five waves beginning in 2001 and ending in 2009, yielding a nationally representative sample of more than 11,000 secondary school–age students satisfying the criteria, including approximately 1,000 DHH students. Sample selection, sample attrition, and representativeness were more fully described by SRI International (2000) and Javitz and Wagner (2005). Weights were computed taking into account the various youth and school characteristics used as stratifying variables in the sampling and nonresponse in those strata. Analyses were weighted to yield estimates that generalized to the national population of DHH students in the NLTS2 age range receiving special education services under the federal hearing impairment category within the NLTS2 time frame. Weights were computed taking into account the various youth and school characteristics used as stratifying variables in the sampling and nonresponse in those strata. Data for this investigation were drawn primarily from secondary school transcripts collected after students' exit from secondary school. Transcripts were obtained for 60% of the eligible DHH sample. To reduce nonresponse bias in analyses of transcript data, transcript weights were modified based on nonresponse analyses. Further details on the weighting strategy can be found in Newman et al. (2011).

Data for this investigation were drawn primarily from secondary school transcripts collected after students' exits from secondary school. To provide a comprehensive description of course taking across a student's time in secondary school, the analyses were based only on

completed transcripts. A transcript was considered to be complete if it included information indicating that the student had graduated, aged out, or dropped out, and included complete information for all the grading periods the student had been in secondary school. Final transcripts were collected between 2002 and 2009, with the majority of students having completed secondary school by 2004. Transcript courses were coded with the Classification of Secondary School Courses codes used by the U.S. Department of Education, National Center for Education Statistics (NCES), for its High School Transcript Study (2002). Credits are expressed here as Carnegie units. A Carnegie unit is a standard of measurement used for secondary education that represents the completion of a course that meets for one period a day of at least 40 minutes for 1 academic year.[2] Information about school type came from NLTS2-administered parent interviews and surveys conducted during the period the student was in secondary school.

The analyses of approximately 610 DHH students involved descriptive statistics (e.g., percentages and means) and bivariate relationships (i.e., cross tabulations), excluding cases with missing values. In the tables accompanying the present article, a standard error is presented for each mean and percentage. When reporting the average and total number of credits earned, both overall and by subject area, we counted courses with zero credits (because of a failing course grade or because they were non–credit-bearing course) as zero credits. All statistics were weighted to be representative of the larger population of secondary school–age DHH students identified for special education services under the hearing impairment category; no imputation of missing values was conducted. (The rate of missing values ranged from 1% to 3%.) Comparisons between DHH students and students in the general population and DHH students in the different types of secondary schools were conducted using two-sample *t* tests with unequal variances.

Comparison data were taken from the NCES Education Longitudinal Study of 2002 (ELS:2002), High School Transcript Study. ELS:2002 included a nationally representative sample of approximately 16,200 youths who were sophomores in secondary school in 2002. In late 2004 and early 2005, about 6 months to 1 year after most of the students had completed secondary school, transcripts were collected from all their secondary schools.</>

Types of School Settings for DHH Students

To examine the secondary school experiences of DHH students attending different types of schools, we grouped students into three categories:

- Those who had attended regular secondary schools, that is, the types of schools serving a wide variety of students, as well as magnet, charter, alternative, and vocational schools. Students who attended these types of schools across all waves of data collection while they were still in secondary school, according to parent or student report, were included in this category.[3]
- Those who had attended special secondary school only, including schools serving only students with disabilities (e.g., schools for the deaf). Students who attended special schools across all waves of data collection while they were still in secondary school, according to parent or student report, were included in this category.
- Those who had attended both types of secondary schools over time, with approximately equal percentages transferring from a regular school to a special school and from a special school to a regular school.

Students in nonschool settings such as a hospital, home school, or juvenile justice facility were excluded from the analyses (0.2% of secondary school–age DHH students). Among students in the analysis sample, 78% attended regular schools only, 14% attended special schools

only, and 8% attended both types of schools over time. Students in all three types of school settings were included in the overall findings, but findings by school type are presented for those who had been in regular secondary or special secondary schools only.

Among DHH students in the sample there were some demographic and disability differences based on type of schools attended. Students who attended regular secondary schools did not differ from those who attended special secondary schools on the basis of individual, demographic, or family characteristics (Shaver et al., 2014). However, students attending both types of school over time were more likely to be Hispanic and were less likely than those who attended regular secondary schools to live in two-parent households (Shaver et al., 2014). DHH students in regular secondary schools were more likely to be reported to be hard of hearing than students in special secondary schools or those who attended both types of schools. Conversely, those students who attended special secondary schools or both types of schools were more likely to be reported as deaf (Shaver et al., 2014). Parent-reported level of hearing loss was much greater among students who attended special schools or those who attended both types of schools than among those in regular schools. The parents of students in regular secondary schools were more likely than those in special secondary schools to report additional disabilities. However, whether students had multiple disabilities or a diagnosis of any particular disability or condition as an additional disability, or whether students had a health problem, did not vary by school type (Shaver et al., 2014).

Results

Overview of Course Credits Earned in Secondary Schools

Overall, DHH students earned an average of 25.9 credits; by comparison, students in the general population earned an average of 24.2 ($p < .05$; Table 1). The majority of credits DHH students earned were in academic courses (15.5), with the total not being significantly different from the number earned by the general population (15.1). DHH students, however, earned more credits in vocational courses and other courses than their peers in the general population (4.7 vs. 3.1, and 5.7 vs. 4.9, $p < .001$ for both comparisons). The average number of credits earned overall in secondary school courses did not differ between DHH students who attended regular schools only and those who attended special schools only. In addition, the average number of credits earned in academic courses and other secondary school courses (nonvocational/nonacademic) was not significantly different by type of secondary school attended. However, DHH students who attended special schools earned more vocational credits than DHH students in regular schools (5.7 vs. 4.5, $p < .05$).

<Table 1>

Credits Earned in Academic Courses

Academic credits accounted for a smaller proportion of overall credits for DHH students than for their peers in the general population (59.7 % vs. 66.4%, $p < .001$; Table 2). There also were significant differences between DHH students and students in the general population in the average number of credits earned in specific types of academic courses. DHH students earned, on average, more credits in English than their peers in the general population (5.0 vs. 4.1, respectively, $p < .001$). However, DHH students earned, on average, fewer credits than students in the general population in science (2.8 vs. 3.0, $p < .05$), social studies (3.4 vs. 3.8, $p < .001$), and foreign language (0.9 vs. 1.8, $p < .001$). The overall average number of math credits did not differ between DHH students and students in the general population, but the types of math

courses differed. DHH students earned more basic math credits (e.g., consumer, basic, general, or remedial math) than their peers in the general population (1.7 vs. 0.5, $p < .001$). Conversely, they earned on average fewer credits in midlevel math courses (e.g., algebra and geometry) and advanced math courses (e.g., algebra/trigonometry, precalculus, statistics) than students in the general population (1.5 vs. 2.0 and 0.2 vs. 1.8, respectively, $p < .001$ for both sets of comparisons).

The percentage of overall credits earned in academic courses did not differ by the type of secondary school attended. However, there were differences in the average number of credits earned in courses in different disciplines. DHH students who attended special schools earned, on average, more credits in English than those in regular schools (6.6 vs. 4.6, $p < .001$). They earned fewer credits in science (2.4 vs. 2.9, $p < .05$), social studies (2.8 vs. 3.5, $p < .01$), and foreign language (0.3 vs. 1.0, $p < .001$) than DHH students who attended regular schools. The overall number of math credits did not differ by type of school attended; however, DHH students in special schools earned, on average, more credits in basic math courses (2.5 vs. 1.6, $p < .01$) and fewer in midlevel math courses (1.0 vs. 1.6, $p < .01$) than those in regular schools.

<Table 2>

Credits Earned in Vocational Courses

DHH students earned a greater proportion of their overall credits in vocational courses than students in the general population (17.7% vs. 13.9 %, $p < .001$; Table 3). In addition, DHH students earned more credits in each of the three types of vocational courses than students in the general population: prevocational (0.9 vs. 0.5, $p < .001$), occupational vocational (3.5 vs. 2.6, $p < .001$), and work study/cooperative education courses (0.4 vs. 0.1, $p < .001$).

The percentage of credits earned in vocational courses also differed somewhat by type of secondary school attended. Vocational courses accounted for a higher proportion of overall credits for DHH students in special schools than for those in regular schools (20.8% vs.16.8%, $p < .05$). DHH students in special schools earned, on average, more credits in work study/cooperative education courses than DHH students who attended regular schools (0.9 vs. 0.2, $p < .01$).

<Table 3>

Credits Earned in Nonacademic/Nonvocational Courses

Nonacademic/nonvocational courses are courses such as life skills, learning support, physical education and health, and fine and performing arts. These types of courses accounted for a greater proportion of overall course credits for DHH students than for students in the general population (22.6 % vs. 20.7 %, $p < .01$; Table 4). DHH students also earned more credits than their peers in the general population in life skills courses (1.6 vs. 1.0, $p < .001$) and learning support classes (0.7 vs. 0.3, $p < .001$).

The average numbers of credits DHH students earned in specific types of nonacademic/nonvocational courses also varied by secondary school type. DHH students who attended special schools only earned more life skills credits (2.2 vs. 1.4, $p < .01$) but fewer credits in learning support courses (0.4 vs. 0.8, $p < .05$) than students who attended only regular schools.

<Table 4<

Credits Earned by DHH Students in Regular Secondary Schools by Instructional Settings

DHH students attending regular schools may spend part of their school days in special education classrooms or resource rooms rather than regular general education classrooms. In the

present section, we focus specifically on students who attended regular secondary schools only, comparing credits earned in special classrooms (including resource rooms) and general education classrooms. DHH students who attended regular secondary schools earned 79.0% of their overall credits in general education classrooms and 20.8% in special education classrooms ($p < .001$; Table 5). DHH students in regular schools were more likely to take courses in general education classrooms than in special education classrooms across course types. They earned 76.4% of their overall academic credits, 87.9% of their vocational credits, and 82.6% of their nonacademic, nonvocational credits in general education classrooms, compared with 23.4%, 12.1%, and 16.6%, respectively, earned in special education classrooms ($p < .001$ for all comparisons).

The proportion of credits earned in academic courses taken in general education classrooms ranged from 72.9% for English courses to 94.7% for foreign language courses ($p < .001$ for all comparisons with courses taken in special education classrooms). The proportion of vocational credits earned in general education classrooms ranged from 75.4% for prevocational courses to 93.0% for occupation-specific courses ($p < .001$ for all comparisons with courses taken in special education classrooms). Among nonacademic, nonvocational courses, fine and performing arts, physical education and health, and life skills credits were earned primarily in general education classrooms (96.7%, 94.4%, and 83.4% respectively), whereas the majority of learning support credits (72.0%) were earned in special education classrooms ($p < .001$ for all comparisons).</>

Table 5>

Discussion

As schools work to raise the number of students who leave secondary school ready for college and career by increasing both the number of academic courses required and the overall

rigor of the curriculum, they must ensure that students with disabilities, including DHH students, are not left behind. They can do this by equipping such students with the academic knowledge and noncognitive skills to fulfill their individual potential, compete with other workers, and lead full and independent lives. The present study, drawing on data from NLTS2, was designed to focus on DHH students' college and career readiness by investigating their opportunities to acquire college and career skills, operationalized in this study as courses taken in secondary school. We examined how DHH students' course taking compared with that of their peers in the general population, how it varied by type of secondary school, and how it varied by instructional setting for DHH students educated in regular schools.

The findings revealed that although DHH students earned more credits overall than their peers in the general population, both groups earned a similar number of credits in academic courses. Where they differed was in their other course taking. DHH students took more vocational and other nonacademic courses than students in the general secondary school population. DHH students in special schools took more vocational and other nonacademic courses than DHH students in regular schools or than peers in the general population. While we do not imply that taking CTE courses diminishes DHH students' chances of acquiring skills necessary to enter productive careers, these differences between DHH students and students in the general population do require further investigation. The focus of other nonacademic courses differed by type of school; DHH students in special schools were more likely to take courses on functional life skills, whereas DHH students in regular schools earned more credits in learning support courses. These differences in course taking may reflect the unique learning needs of DHH students placed in each school type (Stinson & Kluwin, 2011); the perceptions of parents,

educators, or the students themselves with regard to such needs; or the availability of courses in different educational settings.

DHH students took fewer courses in science, social science, and foreign languages than their peers in the general population. These differences were more pronounced for DHH students in special schools because they took fewer courses in science, social science, and foreign languages than their DHH peers in regular schools and secondary school students in general. As was the case with differences in vocational and nonacademic courses taken, whether these situations resulted from student needs, perceived needs, or simply course availability in the case of special schools remains to be determined. In any case, these differences may place DHH students at a disadvantage compared with their hearing peers when they reach college and the workplace because they most likely will not have the same academic background knowledge. This suggestion is consistent with findings from the study by Marschark et al. (2015), which found that, overall, DHH students scored significantly below peers in the general population on achievement tests in reading comprehension, math, social studies, and science. In addition, DHH students in special schools scored significantly below DHH students in regular schools across all those areas.

We also found evidence that DHH students' academic courses in math lacked the rigor of those taken by hearing peers. Whereas DHH students and students in the general population did not differ significantly in the average number of math credits earned, DHH students earned more credits in basic math than their peers and fewer credits in midlevel math courses such as Algebra I, and even fewer in advanced math courses such as precalculus. Further, the study revealed that, on average, DHH students in special schools earned fewer credits in midlevel and advanced math courses than DHH students in regular schools. It is unclear whether the latter finding reflects

different abilities—and thus, course needs—of DHH students in different educational settings or the ability of special schools with relatively small enrollments to provide the same range of courses as regular schools. Given the need for more students to study in the STEM (science, technology, engineering, and math) areas, however, the gap in science and math course taking between DHH students and their peers in the general population is particularly troubling (Lang, 2011). The lack of DHH students' exposure to midlevel and advanced math courses is also of concern in light of the findings of Shaver, Newman, Huang, Yu, and Knokey (2011) regarding DHH students' math achievement as measured by the Woodcock-Johnson III Tests of Achievement (WJ-III). Shaver and colleagues reported that DHH students' mean score on the math calculation subtest and applied problem solving were significantly below the performance of their general population peers.

The finding that DHH students in regular schools and special schools took more basic math courses during secondary school than their peers in the general population also suggests that DHH students followed a different sequence of math classes, a path that lacked progression through the content area that is required to be college and career ready. Given that specific course-taking sequences, particularly in math, are correlated with future postsecondary school success (Adelman, 2006), the focus on basic math throughout secondary school has important implications for DHH students' college and career readiness. We did not analyze when in their academic careers DHH students took specific math courses. This is important, given the gatekeeping function of some math courses (e.g., Algebra I) for further math and science study (F. G. Paul, 2005). If DHH students took a gatekeeping math course late in secondary school, they would not have sufficient time to pursue more advanced classes. Pagliaro and Ansell (2002) and Pagliaro and Kritzer (2005) have suggested that teachers in special schools are more

reluctant than those in regular schools to provide DHH students with higher-level math instruction until they are comfortable that these students possess the more basic skills, although DHH students' language skills and teachers' own math backgrounds also are possibly involved (Kelly, Lang, & Pagliaro, 2003; Pagliaro, 1998). Whatever the reason, the lack of exposure to midlevel and advanced math places DHH students' futures at risk, given the link between rigorous math and success in college and careers.

The findings that DHH students earned fewer credits in science and social studies relative to the general population and that DHH students in regular schools earned more credits in those areas than their DHH peers in special schools again raises the question of opportunities to learn and academic achievement in these areas. Compared with the 50% of youth in the general population who scored 100 or below, 86% of secondary school DHH students had standard scores in that range on the science and social studies WJ-III subtests (Shaver et al., 2011). The findings concerning DHH students' course taking in English raise questions about the accessibility and quality of the academic content in those courses. Although DHH students in regular schools and special schools in particular earned more credits in English than their general education peers, possibly reflecting greater need (Trezek, Wang, & P. V. Paul, 2011), this intensity does not appear to lead to higher achievement. Shaver and colleagues (2011) reported that compared with the 50% of youth in the general population who scored 100 or below, 87% of DHH secondary school students scored in that range on the passage comprehension subtest and 81% scored in that range on the synonyms/antonyms subtest. The extent to which such findings reflect generalized (if not universal) limitations on DHH students' acquisition of English literacy and/or result from specific language, developmental, and educational factors is a complex subject beyond the scope of the present study (see Knoors & Marschark, 2014, ch. 8; Trezek et al., 2011).

Limitations

The present study had several limitations, including the age of the data collected. As noted, NLTS2 involved data collection from multiple sources across several waves from 2001 to 2009. The nationally representative sample of more than 11,000 secondary school–age students includes approximately 1,000 DHH students who received special education services in the 2000–2001 school year. It might be suggested that those students may not be fully representative of the current population of DHH students receiving special education services, many of whom are using cochlear implants. Yet the finding by Qi and Mitchell (2012) that the academic achievement of DHH secondary school students has been remarkably consistent over the past 30–40 years suggests that the age of the NLTS2 data may not be an issue. Moreover, recent studies involving secondary school students and college students have not found cochlear implants to be a significant predictor of achievement scores (e.g., Marschark et al., 2015), classroom learning (Convertino, Marschark, Sapere, Sarchet, & Zupan, 2009), or world knowledge (Convertino, Borgna, Marschark, & Durkin, 2014), even if they often are associated with some academic advantages among young DHH children. Data from NLTS2 are one of the few sources of information regarding secondary school experiences and the transition to adult life, and the only such source for a nationally representative sample of DHH students (see Shaver et al., 2014, for discussion). Until more current information or contradictory findings are obtained, the NLTS2 data continue to offer the best available picture of this population.

Another possible limitation is inherent in the changes in academic expectations for all students, including those who receive special education, that have occurred since the final wave of NLTS2 data collection in 2009. The CCSS in math and English-language arts, developed in 2010 by the Council of Chief State School Officers and the National Governors Association

Center for Best Practices and adopted by many states, represent the next generation of K–12 standards designed to prepare all students for success in college, careers, and life by the time they graduate from secondary school (Achieve, 2013). Similarly, the Next Generation Science Standards (NGSS), adopted by more than half a dozen states, are designed to improve science instruction for all students from kindergarten to secondary school (Next Generation Science Standards Lead States, 2013). The CCSS and the NGSS demand increased cognitive expectations of all students, including those who struggled to demonstrate mastery even under the previous generation of less cognitively demanding state-specific content standards. Consequently, course-taking patterns may have changed in response to the increased academic rigor of the CCSS and NGSS.

Finally, despite efforts to ensure the gathering of a study population representative of the full population of DHH youth, systematic differences may exist between those who participated in the present study and those who did not. Consequently, the present results may not be fully representative of the entire population of DHH secondary students in the United States. As noted earlier, however, this dataset is the best we have. Moreover, the results of this study and others using NLTS2 data appear fully consistent with recent reports and ongoing studies involving smaller samples of DHH students in the United States and elsewhere, in both special schools and regular schools (Antia, 2015; Knoors & Marschark, 2014). That work includes, in particular, the development and assessment of interventions designed to enhance DHH students' math abilities and studies of relations among math and various cognitive abilities (see Gottardis, Nunes, & Lunt, 2011; Nunes, Barros, Evans, & Burman, 2014; Pagliaro, 2015 in press).</>

Research Implications

The findings of the present study indicate that DHH students may not have the same access to academic courses as their hearing peers in science, social studies, and foreign languages; often do not have exposure to challenging math courses; and may follow different secondary course-taking patterns in math. More research therefore is needed to examine DHH students' access to courses that promote college and career readiness as well as ways to facilitate uptake of information in those courses for students who may lack the language fluency, content knowledge, and world knowledge of peers in the general population. Specific topics of investigation might include an examination of the math courses DHH students take in each grade in secondary school and how the patterns of course content and outcomes compare with those of their hearing peers. Given the apparent gatekeeping role of algebra, it might also be asked whether DHH students who take Algebra I and other more challenging math courses take them in the same grade as their hearing peers. Perhaps most revealing would be the paired questions of what the postschool outcomes are of DHH students who take midlevel and/or advanced courses compared with those DHH students who do not and what the academic course histories are of DHH individuals who have been successful in college and the workplace.

1. Students were sampled under the federal disability category of "hearing impairment." DHH students who were sampled included those who were reported by their parents to have a range of hearing loss from mild to profound. In the present article, we refer to this population as "deaf and hard of hearing" (DHH) students, following the convention used in deaf education and related research following the 1991 joint statement by the World Federation of the Deaf and the

International Federation of Hard of Hearing People, rejecting “hearing impairment” in favor of “deaf and hard of hearing.”

2. In NLTS2, the number of credits, in Carnegie units, usually was indicated on transcripts. For the courses that did not have them assigned, Carnegie units were based on the scale the school had used and on the duration or intensity of the course. Courses that were not in Carnegie units were converted to the Carnegie standard unit of one period per day per academic year.

3. The NLTS2 database does not contain information about school type for every year of students’ enrollment in secondary school. This information is available only for years of data collection waves (every other year) for which there was a completed parent or youth interview or survey for youth who were still enrolled in secondary school.</>

References

Achieve. (2010). *State college- and career-ready high school graduation requirements.* Retrieved from http://www.achieve.org/files/21CCRDiplomaTableMay2010.pdf

Achieve. (2012). *Closing the expectations gap: Fifty state progress report on the alignment of state K–12 policies and practices with the demands of college and career*. Retrieved from http://www.achieve.org/files/Achieve201250StateReport.pdf

Achieve. (2013). *Closing the expectations gap: 2013 annual report on the alignment of state K–12 policies and practices with the demands of college and career*. Retrieved from http://www.achieve.org/files/2013ClosingtheExpectationsGapReport.pdf

Achieve & National Association of State Directors of Career and Technical Educational Consortium. (2014). *Making career readiness count*. Retrieved from http://www.achieve.org/files/Achieve-NASDCTEc_Career_Readiness.PDF

ACT. (2004). *Crisis at the core: Preparing all students for college and work*. Iowa City, IA: Author.

ACT. (2006). *Benefits of a high school core curriculum*. Iowa City, IA: Author.

ACT. (2007). *Issues in college success: The role of nonacademic factors in college readiness and success*. Retrieved from https://www.act.org/research/policymakers/pdf/nonacademic_factors.pdf

ACT. (2012). *The condition of college and career readiness 2012***.** Retrieved from http://www.act.org/research-policy/college-career-readiness-report-2012/

Alliance for Excellent Education. (2009). Reinventing the federal role in education: Supporting the goal of college and career readiness for all students (Policy brief). Washington, DC: Author.

Adelman, C. (1999). *Answers in the toolbox: Academic intensity, attendance patterns, and bachelor's degree attainment* (Report No. PLLI-1999-8021). Washington, DC: National Institute on Postsecondary Education, Libraries, and Lifelong Learning (ED/OERI).

Adelman, C. (2006). *The toolbox revisited: Paths to degree completion from high school through college*. Washington, DC: U.S. Department of Education.

Albertini, J. A., Kelly, R. R., & Matchett, M. K. (2011). Personal factors that influence deaf college students' academic success. *Journal of Deaf Studies and Deaf Education, 17*, 85–101.

Allen, T. E., & Anderson, M. L. (2010). Deaf students and their classroom communication: An evaluation of higher-order categorical interactions among school and background characteristics *Journal of Deaf Studies and Deaf Education, 15,* 334–347.

Alwell, M., & Cobb, B. (2007). *Social/communicative interventions and transition outcomes for youth with disabilities: A systematic review*. Boone, NC, and Fort Collins, CO: Appalachian State University and Colorado State University. Retrieved from National Secondary Transition Technical Assistance Center website: http://www.nsttac.org/sites/default/files/assets/pdf/pdf/social_communications_skills_full_text.pdf

American Institutes for Research. (2013). *How career and technical education can help students be college and career ready: A primer*. Retrieved from American Youth Policy Forum website: http://www.aypf.org/wp-content/uploads/2013/04/CCRS-CTE-Primer-2013.pdf

Antia, S. (2015). Enhancing academic and social outcomes: Balancing individual, family, and school assets and risks for deaf and hard-and-hearing students in general education. In H. Knoors & M. Marschark (Eds.), *Educating deaf learners: Creating a global evidence*

base (pp. 527-546). New York, NY: Oxford University Press.

Association for Career and Technical Education. (2010). *What is "career ready"?* Retrieved from http://www.acteonline.org/uploadedFiles/Publications_and_Online_Media/files/Career_Readiness_Paper_COLOR.pdf

Bernanke, B. (2007, September 24). *Education and economic competitiveness* [Speech to the U.S. Chamber Education and Workforce Summit, Washington, DC]. Retrieved from Federal Reserve System website: http://www.federalreserve.gov/newsevents/speech/bernanke20070924a.htm

Blanchfield, B. B., Feldman, J. J., Dunbar, J. L., & Gardner, E. N. (2001). The severely to profoundly hearing-impaired population in the United States: Prevalence estimates and demographics. *Journal of the American Academy of Audiology, 12*, 183–189.

Buddin, R., & Croft, M. (2014). *Do stricter high school graduation requirements improve college readiness?* (ACT Working Paper No. 2014-1). Retrieved from ACT website: https://www.act.org/research/papers/pdf/wp-2014-1.pdf

Bullis, M., Davis, C., Bull, B., & Johnson, B. (1995). Transition achievement among young adults with deafness: What variables relate to success? *Rehabilitation Counseling Bulletin, 39*, 130–150.

Business Roundtable. (n.d.). *Working to close the skills gap*. Retrieved from http://businessroundtable.org/closingtheskillsgap

Career Readiness Partner Council. (n.d.). *Building blocks for changes: What it means to be career ready*. Retrieved from http://careerreadynow.org/docs/CRPC_4pagerB.pdf

Carnevale, A. P, Smith, N., & Strohl, J. (2010). *Help wanted: Projections of jobs and education*

requirements through 2018. Washington, DC: Center on Education and the Workforce, Georgetown University.

Clarcq, J. R., & Walter, G. G. (1998). Supplemental Security Income payments made to young adults who are deaf and hard of hearing. *Journal of the American Deafness and Rehabilitation Association, 31*(2), 1–8.

Cobb, B., Lehmann, J., Newman-Gonchar, R., & Alwell, M. (2008). *Self-determination for students with disabilities: A narrative meta-synthesis*. Retrieved from National Secondary Transition Technical Assistance Center website: http://www.nsttac.org/sites/default/files/assets/pdf/ pdf/what_works/2d_full_text.pdf

Conforti, P. A. (2013, May). What is college and career readiness? A summary of state definitions. *Pearson Bulletin*, pp. 1–4. Retrieved from http://researchnetwork.pearson.com/wp-content/uploads/TMRS-RIN_Bulletin_22CRCDefinitions_051313.pdf

Conley, D. T. (2012). *A complete definition of college and career readiness*. Retrieved from Educational Policy Improvement Center website: http://www.epiconline.org/publications/

Convertino, C. M., Borgna, G., Marschark, M., & Durkin, A. (2014). Word and world knowledge among deaf students with and without cochlear implants. *Journal of Deaf Studies and Deaf Education, 19*, 471–483.

Convertino, C. M., Marschark, M., Sapere, P., Sarchet, T., & Zupan, M. (2009). Predicting academic success among deaf college students. *Journal of Deaf Studies and Deaf Education, 14*, 324–343.

Council on Competitiveness. (2007). *Competitiveness index: Where America stands*. Retrieved from

http://www.compete.org/storage/images/uploads/File/PDF%20Files/Competitiveness_Index_Where_America_Stands_March_2007.pdf

Danek, M. M., & Busby, H. (1999). *Transition planning and programming: Empowerment through partnership*. Washington, DC: Gallaudet University.

Dougherty, C., Mellor, L., & Jian, S. (2006). *The relationship between advanced placement and college graduation* (2005 AP Studies Series Report No. 1). Austin, TX: National Center for Educational Accountability.

Gamoran, A., & Hannigan, E. C. (2000). Algebra for everyone? Benefits of college preparatory mathematics for students with diverse abilities in early secondary school. *Educational Evaluation and Policy Analysis, 22,* 241–254.

Goldberg, L. R., & Richburg, C. M. (2004). Minimal hearing impairment: Major myths with more than minimal implications. *Communication Disorders Quarterly, 25*, 152–160. doi:10.1177/15257401040250030601

Gottardis, L., Nunes, T., & Lunt, I. (2011). A synthesis of research on deaf and hearing children's mathematical achievement. *Deafness and Education International*, *13*, 131–150.

Hooker, S., & Brand, B. (2009). *Success at every step: How 23 programs support youth on the path to college and beyond*. Retrieved from American Youth Policy Forum website: http://www.aypf.org/publications/SuccessAtEveryStep.pdf

Hoyt, K. B. (1994). A proposal for making transition from schooling to employment an important component of educational reform. In A. Pautler (Ed.), *High school to employment transition: Contemporary issues* (pp. 189–200). Ann Arbor, MI: Prakken.

Javitz, H., & Wagner, M. (2005). *Analysis of potential bias in the Wave 1 and Wave 2*

respondents to the National Longitudinal Transition Study–2 (NLTS2). Menlo Park, CA: SRI International.

Karp, M. M, Calcagno, J. C., Hughes, K. L., Jeong, D. W., & Bailey, T. (2007). *The postsecondary achievement of participants in dual enrollment: An analysis of student outcomes in two states.* St. Paul: National Research Center for Career and Technical Education, University of Minnesota.

Kelly, R. R. (2008). Deaf learners and mathematical problem solving. In M. Marschark & P. Hauser (Eds.), *Deaf cognition* (pp. 226–249). New York, NY: Oxford University Press.

Kelly, R. R. (2015). *The employment and career growth of deaf and hard- of-hearing individuals*. Rochester, NY: REACH Center for Studies on Career Success, National Technical Institute for the Deaf, Rochester Institute of Technology. Retrieved from Raising and Educating Deaf Children website: http://raisingandeducatingdeafchildren.org/node/21239

Kelly, R. R, Lang, H., & Pagliaro, C. (2003). Mathematics word problem solving for deaf students: A survey of practices in grades 6–12. *Journal of Deaf Studies and Deaf Education, 8*, 104–119.

Klepfer, K., & Hull, J. (2012). *High school rigor and good advice: Setting up students to succeed*. Retrieved from Center for Public Education website: http://www.centerforpubliceducation.org/Main-Menu/Staffingstudents/High-school-rigor-and-good-advice-Setting-up-students-to-succeed/High-school-rigor-and-good-advice-Setting-up-students-to-succeed-Full-Report.pd

Knoors, H., & Marschark, M. (2014). *Teaching deaf learners: Psychological and developmental foundations*. New York, NY: Oxford University Press.

Kruse, D., Schur, L., & Ali, M. (2010). Disability and occupational projections. *Monthly Labor Review Online, 133*(10). Retrieved from U.S. Bureau of Labor Statistics website: http://www.bls.gov/opub/ mlr/2010/10/art3exc.htm

Lane, H., Hoffmeister, R., & Bahan, B. (1996). *A journey into the deaf-world*. San Diego, CA: DawnSignPress.

Lang, H. (2011). Perspectives on the history of deaf education. In M. Marschark & P. Spencer (Eds.), *The Oxford handbook of deaf studies, language, and education* (Vol. 1, 2nd ed., pp. 7–17). New York, NY: Oxford University Press.

Lee, J. (2012). College for all: Gaps between desirable and actual P–12 math achievement trajectories for college readiness. *Educational Researcher*, *41*(2), 43–55.

Long, M. C., Conger, D., & Iatarola, P. (2012). Effects of high school course-taking on secondary and postsecondary success. *American Educational Research Journal*, *49*(2), 285–322.

Luckner, J. (2002). *Facilitating the transition of students who are deaf or hard of hearing.* Austin, TX: Pro-Ed.

Marschark, M., Lang, H. G., & Albertini, J. A. (2002). *Educating deaf students: From research to practice*. New York, NY: Oxford University Press.

Marschark, M., Shaver, D., Nagle, K., & Newman, L. (2015). Predicting the academic achievement of deaf and hard-of-hearing students from individual, household, communication, and educational factors. *Exceptional Children, 81*(3), 350–369.

McLaughlin, M. J., & Tilstone, C. (2000). Standards and curriculum: The core of educational reform. In M. Rouse & M. J. McLaughlin (Eds.), *Special education and school reform in the United States and Great Britain* (pp. 38–65). London, England: Routledge.

Moeller, M. P., Tomblin, J. B., Yoshinaga-Itano, C., Connor, C., & Jerger, S. (2007). Current state of knowledge: Language and literacy of children with hearing impairment. *Ear and Hearing, 28*(6), 740–753. doi:10.1097/AUD.0b013e318157f07f

Musen, L. (2010). *Pre-algebra and algebra enrollment and achievement*. Retrieved from Annenberg Institute for School Reform at Brown University website: http://annenberginstitute.org/sites/default/files/product/207/files/LeadingIndicator_Math.pdf

National Governors Association Center for Best Practices & Council of Chief State School Officers. (2010). *Common Core state standards*. Washington, DC: Authors.

National High School Alliance. (2006). *Increasing academic rigor in high schools: Stakeholder perspectives.* Washington, DC: Author.

Next Generation Science Standards Lead States. (2013). *Next Generation Science Standards: For states, by state*s. Washington, DC: National Academies Press.

Newman, L., Wagner, M., Cameto, R., Knokey, A.-M., & Shaver, D. (2010). *Comparisons across time of the outcomes of youth with disabilities up to 4 years after high school: A report of findings from the National Longitudinal Transition Study (NLTS) and the National Longitudinal Transition Study–2 (NLTS2)* (NCSER Report No. 2010-3008). Menlo Park, CA: SRI International.

Newman, L., Wagner, M., Huang, T., Shaver, D., Knockey, A., Greene, S., et al. (2011). *Secondary school programs and performance of students with disabilities*. Menlo Park, CA: SRI International.

Nunes, T., Barros, R., Evans, D., & Burman, D. (2014). Improving deaf children's working memory through training. *International Journal of Speech and Language Pathology and*

Audiology, 2, 51–66.

Oakes, J., & Saunders, M. (2008). *Beyond tracking: Multiple pathways to college, career, and civic participation*. Boston, MA: Harvard Education Press.

Pagliaro, C. (1998). Mathematics preparation and professional development of deaf education teachers. *American Annals of the Deaf, 143*, 373–379.

Pagliaro, C. (2015). Developing numeracy in individuals who are deaf and hard of hearing. In H. Knoors & M. Marschark (Eds.), *Educating deaf learners: Creating a global evidence base* (173-196). New York, NY: Oxford University Press.

Pagliaro, C., & Ansell, E. (2002). Story problems in the deaf education classroom: Frequency and mode of presentation. *Journal of Deaf Studies and Deaf Education, 7,* 107–119.

Pagliaro, C., & Kritzer, K. (2005). Discrete mathematics in deaf education: A survey of teachers' knowledge and use. *American Annals of the Deaf, 150*, 251–259.

Patton, J. R., & Trainor, A. (2002). Using applied academics to enhance curricular reform in secondary education. In C. Kochar-Bryant & D. S. Basset (Eds.), *Aligning transition and standards-based education: Issues and strategies* (pp. 55–75). Arlington, VA: Council on Exceptional Children.

Paul, F. G. (2005). Grouping within Algebra I: A structural sieve with powerful effects for low-income, minority, and immigrant students. *Educational Policy, 19,* 262–282.

Plank, S., DeLuca, S., & Estacion, A. (2005). *Dropping out of high school and the place of career and technical education: A survival analysis of surviving high school*. St. Paul, MN: National Research Center for Career and Technical Education.

Porter, A. C., & Polikoff, M. S. (2012). Measuring academic readiness for college. *Educational Policy, 26*, 394–417.

Qi, S., & Mitchell, R. E. (2012). Large-scaled academic achievement testing of deaf and hard-of-hearing students: Past, present, and future. *Journal of Deaf Studies and Deaf Education, 17*, 1–18.

Robbins, S., Lauver, K., Le, H., Davis, D., Langley, R., & Carlstrom, A. (2004). Do psychological and study skill factors predict college outcome? A meta-analysis. *Psychological Bulletin, 130,* 261–288.

Roderick, M., Nagaoka, J., & Coca, V. (2009). College readiness for all: The challenge for urban high schools. *Future of Children, 19*(1), 185–210.

Rumberger, R. W., & Larson, K. A. (1998). Student mobility and the increased risk of high school dropout. *American Journal of Education, 107*(1), 1–35.

Schley, S., Walter, G. G., Weathers, R. R., Hemmeter, J., Hennessey, J. C., & Burkhauser, R. V. (2011). Effect of postsecondary education on the economic status of persons who are deaf or hard of hearing. *Journal of Deaf Studies and Deaf Education, 16*, 524–536. doi:10.1093/deafed/enq060

Schroedel, J. G. (1991). Improving the career decisions of deaf seniors in residential and day high schools. *American Annals of the Deaf, 136*, 330–338.

Shaver, D., Marschark, M., Newman, L., & Marder, C. (2014). Who is where? Characteristics of deaf and hard-of-hearing students in regular and special schools. *Journal of Deaf Studies and Deaf Education*, *19*, 203–219.

Shaver, D., Newman, L., Huang, T., Yu, J., & Knokey, A.-M. (2011). *Facts from NLTS2: The secondary school experiences and academic performance of students with hearing impairments*. Menlo Park, CA: SRI International. Retrieved from National Center for

Special Education Research website: https://ies.ed.gov/ncser/pubs/20113003/pdf/20113003.pdf

Southern Regional Education Board. (2013). *Essential elements of state policy for college completion: State policies to support a statewide college and career readiness agenda*. Retrieved from http://publications.sreb.org/2013/Ess_Elem_Readiness.pdf

Spring, J. (1997). *The American school 1642–1996.* New York, NY: McGraw-Hill.

SRI International. (2000). *National Longitudinal Transition Study–2 (NLTS2): Study design, timeline, and data collection plan*. Menlo Park, CA: Author.

Stein, M. K., Kaufman, J. H., Sherman, M., & Hillen, A. F. (2011). Algebra: A challenge at the crossroads of policy and practice. *Review of Educational Research, 81,* 453–492.

Stinson, M., & Kluwin, T. (2011). Educational consequences of alternative school placements. In M. Marschark & P. Spencer (Eds.), *The Oxford handbook of deaf studies, language, and education* (Vol. 1, 2nd ed., pp. 47–62). New York, NY: Oxford University Press.

Szymanski, C., Lutz, L., Shahan, C., & Gala, N. (2013). *Critical needs of students who are deaf or hard of hearing: A public input summary.* Washington, DC: Laurent Clerc National Deaf Education Center, Gallaudet University.

Trezek, B., Wang, Y., & Paul, P. V. (2011). Processes and components of reading. In M. Marschark & P. Spencer (Eds.), *The Oxford handbook of deaf studies, language, and education* (Vol. 1, 2nd ed., pp. 99–114). New York, NY: Oxford University Press.

U.S. Department of Education. (2014). *Thirty-fifth annual report to Congress on the Implementation of the Individuals With Disabilities Education Act, 2013.* Retrieved from http://www2.ed.gov/about/reports/annual/osep/2013/parts-b-c/35th-idea-arc.pdf

U.S. Department of Education, National Center for Education Statistics. (2002). *Education*

Longitudinal Study of 2002 (ELS:2002): High school transcript study. Retrieved from https://nces.ed.gov/surveys/els2002/policy.asp

U.S. Department of Education, Office of Planning, Evaluation, and Policy Development. (2010). *ESEA blueprint for reform*. Retrieved from http://www2.ed.gov/policy/elsec/leg/blueprint/blueprint.pdf

U.S. Department of Education, Office of Vocational and Adult Education. (2003). *The high school leadership summit: Issue papers.* Retrieved from http://www2.ed.gov/about/offices/list/ovae/pi/hsinit/papers/index.html?exp=0

U.S. Department of Labor. (2007). *The STEM workforce challenge: The role of the public workforce system in a national solution for a competitive science, technology, engineering, and mathematics (STEM) workforce*. Retrieved from http://www.doleta.gov/youth_services/pdf/STEM_Report_4%2007.pdf

Wagner, M., Newman, L., & Cameto, R. (2004). *Changes over time in the secondary school experiences of students 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. Retrieved from National Center for Special Education Research website: www.nlts2.org/reports/2004_04/nlts2_report_2004_04_complete.pdf

Walter, G., & Dirmyer, R. (2012). *The effect of education on the occupational status of deaf and hard-of-hearing 26–64-year-olds*. Retrieved from National Technical Institute for the Deaf website: http://www.ntid.rit.edu/sites/default/files/effect_of_education_on_occupational.pdf

Weathers, R. R. I., Walter, G., Schley, S., Hennessey, J., Hemmeter, J., & Burkhauser, R. V.

(2007). How postsecondary education improves adult outcomes for Supplemental Security Income children with severe hearing impairments. *Social Security Bulletin, 67*(2), 101–131.

Wiley, A., Wyatt, J., & Camara, W.J.(2010).The development of a multidimensional college readiness index. College Board Research Report 2010–3. Retrieved from https://research.collegeboard.org/sites/default/files/publications/2012/7/researchreport-2010-3-development-multidimensional-college-readiness-index.pdf

Wolgemuth, J. R., Cobb, R. B., & Dugan, J. R. (2006). *The effects of self-management interventions on academic outcomes for youth with disabilities*. Fort Collins: Colorado State University. Retrieved from National Post-School Outcomes Center website: http://www.psocenter.org/content_page_assets/ content_page_35/SelfManagementReview.pdf</>

Table 1

Overview of Credits Earned by Deaf and Hard of Hearing (DHH) Students in Grades 9–12, by School Type

	General population	General population	Overall	Overall	Special schools only	Special schools only	Regular schools only	Regular schools only
	M	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*
Total credits	24.2	0.05	25.9*	0.63	26.5	0.69	25.6	0.79
Academic courses	15.1	0.04	15.5	0.35	15.6	0.44	15.4	0.43
Vocational courses	3.1	0.02	4.7***	0.30	5.7	0.50	4.5*	0.31
Other courses	4.9	0.02	5.7***	0.20	5.3	0.24	5.8	0.26

Note. Students who had attended both special and regular secondary schools are included in the overall findings but are not addressed as a separate group. Means are weighted population estimates based on approximately 610 students in NLTS2 and 14,800 students in ELS:2002. Significant *t* test comparisons between DHH students and general population students are indicated as part of overall DHH student means. Significant school-type comparisons are indicated with regular school DHH student means.

The data sources are U.S. Department of Education, Institute of Education Sciences, National Center for Special Education Research, National Longitudinal Transition Study-2 (NLTS2), transcript data collection, 2002–2009; U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS:2002), High School Transcript Study.

* $p < .05$. *** $p < .001$.

Table 2

Academic Course Taking of Deaf and Hard of Hearing (DHH) Students in Grades 9–12, by School Type

	General population	General population	Overall	Overall	Special schools only	Special schools only	Regular schools only	Regular schools only
	% (*M*)	*SE*	% (*M*)	*SE*	% (*M*)	*SE*	% (*M*)	*SE*
Percentage of courses that were academic	66.4	0.01	59.7***	1.0	58.0	1.33	60.0	1.01
Average number of credits earned:								
English	4.1	0.01	5.0***	0.14	6.6	0.29	4.6***	0.14
Math	3.4	0.01	3.4	0.09	3.5	0.18	3.4	0.09
Basic math	0.5	0.01	1.7***	0.13	2.5	0.24	1.6**	0.14
Midlevel math	2.0	0.01	1.5***	0.09	1.0	0.18	1.6**	0.11
Advanced math	1.8	0.01	0.2***	0.04	0.0	0.03	0.2	0.05
Science	3.0	0.01	2.8*	0.09	2.4	0.21	2.9*	0.12
Social studies	3.8	0.01	3.4***	0.12	2.8	0.21	3.5**	0.13
Foreign language	1.8	0.01	0.9***	0.09	0.3	0.11	1.0***	0.11

Note. Students who had attended both special and regular schools are included in the overall findings but are not addressed as a separate group. Numbers are weighted population estimates based on approximately 610 students in NLTS2 and 14,800 students in ELS:2002. Significant *t* test comparisons between DHH students and general population students are indicated as part of overall DHH student means. Significant school-type comparisons are indicated with regular school DHH student means.

The data sources are U.S. Department of Education, Institute of Education Sciences, National Center for Special Education Research, National Longitudinal Transition Study–2 (NLTS2), transcript data collection, 2002–2009; U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS:2002), High School Transcript Study.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 3

Vocational Course Taking of Deaf and Hard of Hearing (DHH) Students in Grades 9–12, by School Type

	General population	General population	Overall	Overall	Special schools only	Special schools only	Regular schools only	Regular schools only
	% (*M*)	*SE*	% (*M*)	*SE*	% (*M*)	*SE*	% (*M*)	*SE*
Percentage of credits earned in vocational courses	13.9	0.01	17.7***	1.00	20.8	1.60	16.8*	1.00
Average number of credits earned:								
Prevocational courses	0.5	0.01	0.9***	0.10	1.0	0.13	0.8	0.13
Occupational vocational courses	2.6	0.02	3.5***	0.27	3.8	0.47	3.4	0.29
Work study/cooperative education courses	0.1	0.01	0.4***	0.06	0.9	0.21	0.2**	0.06

Note. Students who had attended both special and regular schools are included in the overall findings but are not addressed as a separate group. Numbers are weighted population estimates based on approximately 610 students in NLTS2 and 14,800 students in ELS:2002. Significant *t* test comparisons between DHH students and general population students are indicated as part of overall DHH student means. Significant school-type comparisons are indicated with regular school DHH student means.

The data sources are U.S. Department of Education, Institute of Education Sciences, National Center for Special Education Research, National Longitudinal Transition Study–2 (NLTS2), transcript data collection, 2002–2009; U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS:2002), High School Transcript Study.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 4

Nonacademic, Nonvocational Course Taking of Deaf and Hard of Hearing (DHH) Students in Grades 9–12, by School Type

	General population	General population	Overall	Overall	Special schools only	Special schools only	Regular schools only	Regular schools only
	% (*M*)	*SE*	% (*M*)	*SE*	% (*M*)	*SE*	% (*M*)	*SE*
Percentage of credits earned in nonacademic, nonvocational courses	20.7	0.01	22.6**	0.61	21.2	1.39	23.0	0.78
Average credits earned in:								
Life skills	1.0	0.01	1.6***	0.11	2.2	0.27	1.4**	0.14
Learning support	0.3	0.01	0.7***	0.11	0.4	0.09	0.8*	0.13
Physical education and health	1.6	0.01	1.7	0.09	1.4	0.16	1.8	0.10
Fine and performing arts	1.8	0.02	1.5	0.14	1.0	0.26	1.6	0.17

Note. Students who had attended both special and regular schools are included in the overall findings but are not addressed as a separate group. Numbers are weighted population estimates based on approximately 610 students in NLTS2 and 14,800 students in ELS:2002. Significant *t* test comparisons between DHH students and general population students are indicated as part of overall DHH student means. Significant school-type comparisons are indicated with regular school DHH student means.

The data sources are U.S. Department of Education, Institute of Education Sciences, National Center for Special Education Research, National Longitudinal Transition Study–2 (NLTS2), transcript data

collection, 2002–2009; U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS:2002), High School Transcript Study.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 5

Credits Earned in Course Content Areas by Deaf and Hard of Hearing (DHH) Students in Regular Schools, by Instructional Setting

	General education	General education	Special education	Special education
	N/%	*SE*	*N*/%	*SE*
Average number of credits earned (380)	20.7	0.87	4.9***	0.43
Average percentage of credits earned (380)	79.0	1.49	20.8***	1.49
Percentage of credits earned by students who had earned credits in:				
Academic courses				
Overall (380)	76.4	2.29	23.6***	2.29
English (370)	72.9	2.73	27.2***	2.73
Math (370)	77.2	3.12	22.8***	3.17
Science (360)	83.2	2.31	16.8***	2.31
Social studies (370)	79.6	2.66	20.4***	2.66
Foreign language (180)	94.7	2.68	5.3***	2.68
Vocational courses				
Overall (360)	87.9	1.80	12.1***	1.80
Prevocational courses (160)	75.4	5.07	24.2***	5.07
Occupation-specific courses (340)	93.0	1.84	7.0***	1.84
Work study or cooperative education (40)	62.9	10.38	37.1	10.37
Nonacademic, nonvocational courses				

	General education	General education	Special education	Special education
Overall (380)	82.6	1.81	17.4***	1.81
Physical education and health courses (350)	94.4	1.51	5.6***	1.51
Learning support courses (150)	28.1	6.62	72.0***	6.62
Life skills courses (330)	83.4	2.89	16.6***	2.89
Fine and performing arts courses (300)	96.7	1.30	3.3***	1.30

Note. Percentages are weighted population estimates derived from analyses in which the total sample ranged across types of courses from approximately 40 (work study or cooperative education) to 380 (academic courses overall), representing the percentage of students enrolled in the course type who took the course(s) in a general education or a special education setting. Students attending special schools such as schools for the deaf are not included in these analyses.

The data source is U.S. Department of Education, Institute of Education Sciences, National Center for Special Education Research, National Longitudinal Transition Study–2 (NLTS2), transcript data collection, 2002–2009.

*** $p < .001$.