School Psychology Review,
2016, Volume 45, No. 3, pp. 362–371

Research Brief

Comparison of Students' Achievement: Deaf, Learning Disabled, and Deaf With a Learning Disability

Jacqueline M. Caemmerer, Stephanie W. Cawthon, and Mark Bond
The University of Texas and pepnet 2

Abstract. Approximately half of students who are deaf or hard of hearing (DHH) have a co-occurring disability. Although assessing as well as diagnosing learning disabilities (LDs) is particularly difficult in this population, it is important to properly identify students who may be eligible for academic interventions or accommodations. This study analyzed national samples of students who are (a) classified with an LD, (b) DHH, and (c) DHH and classified with an LD. The three samples were compared in terms of their performance on a standardized measure of academic achievement. The results of our exploratory analyses suggest that math calculation skills and classroom grades are useful in classifying students who are DHH with an LD. We discuss the implications of these findings, limitations to the dataset, and areas for further research.

Individuals who are deaf or hard of hearing (DHH) are linguistically and culturally diverse (Bat-Chava, 2000; Mitchell & Karchmer, 2011). Adding to this diversity is the possibility that students who are DHH may also have disabilities that affect areas of their academic functioning. The National Association of School Psychologists (NASP) stated that there is a need for school psychologists to recognize and address this heterogeneity among students who are DHH to better support their education and service delivery (NASP, 2012). However, because of problematic assessment measures and challenges when interpreting findings, there is a growing concern that students who are DHH who have a disability are being improperly identified (Soukup & Feinstein, 2007). To support the learning of students who are DHH and have a co-occurring disability, which is estimated to

Work on this project is partially supported by pepnet 2 (www.pepnet.org). Pepnet 2 is funded by the Research to Practice Division, Office of Special Education Programs, U.S. Department of Education, via Cooperative Agreement H326D110003. Funding is provided from October 1, 2011, to September 30, 2016. The findings reflected herein do not represent the views of the U.S. Department of Education and should not be taken as an endorsement for any product.

Correspondence concerning this article should be sent to Jacqueline M. Caemmerer, Department of Educational Psychology, The University of Texas at Austin, 504 SZB, One University Station, D5800, Austin, TX 78712-0383; e-mail: j.caemmerer@utexas.edu

be 50% of the DHH population (Mitchell & Karchmer, 2011), it is important to properly identify those who meet eligibility criteria for services (Krywko, 2014; Morgan & Vernon, 1994).

As with the general population, learning disabilities (LDs) are the most prevalent disability within the DHH population (Mitchell & Karchmer, 2011). Assessing as well as diagnosing students who are DHH with an LD is, however, a complex process (Morgan & Vernon, 1994; Soukup & Feinstein, 2007). The federal definition of LDs is one contributing factor to this difficulty. An LD is defined as follows (U.S. Department of Education, Office of Special Education Programs, 2006):

> A disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations, including conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia (p. 2).

The definition specifies several exclusionary conditions that preclude a diagnosis, such as a hearing disability and limited English proficiency. If one of the exclusionary conditions is presumed to be the primary cause of the student's learning difficulties, in this case the student's status as DHH, then an additional diagnosis of LD is inadmissible. Determining whether the hearing loss of students who are DHH is the primary cause of their learning difficulties, or whether there is an additional LD present, is thus a challenging task for educators.

Federal criteria also indicate that a student may have an LD if the "child does not achieve adequately for the child's age or to meet State-approved grade-level standards" (U.S. Department of Education, Office of Special Education Programs, 2006, p. 2). To identify a student with an LD and determine if the child requires special education services, a comprehensive evaluation by a trained professional, often a school psychologist, is completed. This evaluation usually includes the administration of standardized cognitive and achievement measures, at a minimum, which allow the school psychologist to compare the child's performance with a nationally representative sample of the child's same-aged peers. Below-average performance on normed achievement tests, in conjunction with a pattern of strengths and weaknesses across various data, may be suggestive of a possible LD (Flanagan, Ortiz, & Alfonso, 2013).

Unfortunately, the standardized achievement tests used to diagnose LDs are not normed on students who are DHH. This means that the reference groups for these tests are not representative of these students (Qi & Mitchell, 2012). In the absence of available DHH norms, most school psychologists compare the performance of students who are DHH with their same-aged hearing peers. Despite the potential accessibility issues in administering standardized achievement tests with students who are DHH, experts still recommend their use as an important part of a comprehensive data-gathering process (Krywko, 2014; Morgan & Vernon, 1994). Unsurprisingly, educators who work with individuals who are DHH report frustration regarding the assessment process and the credibility of results (Soukup & Feinstein, 2007). The implications for diagnosis and intervention are high: Educators criticize assessment reports as being inadequate, being of low quality, and resulting in an unmet need for high-quality evaluations for this population (Cawthon & the RES Team, 2012).

In addition to the lack of appropriate norms for students who are DHH, other factors complicate the LD identification process in this population. Many of these factors that affect LD identification center on issues of language and communication, including variations in language modality and proficiency, the age of onset of hearing loss, exposure to the English language (Mitchell & Karchmer, 2011), and the match between the communication modalities of children and important people in their lives. Students with greater proficiency in American Sign Language (ASL), for example, tended to perform better on standardized reading tests than those with lower ASL proficiency, even after controlling for nonverbal IQ (Freel et al., 2011; Strong & Prinz, 1997). Previous research also suggested that if the hearing parents of students who were DHH competently communicated with their children using sign language, their children were more likely to achieve higher English language achievement scores (Mitchell & Karchmer, 2011). Students who learned English prior to their hearing loss (for those who are later deafened) tended to score higher on standardized tests (especially reading tests) in comparison to students who were born DHH and did not learn English first (Mitchell & Karchmer, 2011). In addition, some students who are DHH use cochlear implants; cochlear implants are surgically implanted electrodes that can provide a sense of sound by addressing individuals' unique hearing loss. Although cochlear implants increase individuals' access to oral conversations, which are thought to be a key incidental learning experience, a study that compared college students with and without cochlear implants found that both groups performed similarly on word knowledge tests (Convertino, Borgna, Marschark, & Durkin, 2014). Combined, these findings illustrate that students who are DHH are a heterogeneous group and their differences, in turn, may influence their performance on achievement measures that are used to identify an LD.

To better understand the achievement of students who are DHH and the potential identification of LDs, it is helpful to understand the typical achievement levels of this population. Studies suggest that, on average, by the time many students who are DHH reach high school, their reading comprehension performance is several grades lower than their hearing peers (Mitchell & Karchmer, 2011; Qi & Mitchell, 2012; Traxler, 2000). Relative to this large gap in reading performance, the math performance of students who are DHH is more evenly distributed and similar to their hearing peers (Blackorby & Knokey, 2006). Given this knowledge, educators may become concerned if a student struggles to meet the average achievement level of students who are DHH. Unfortunately, the bulk of the research on DHH student achievement only compares their performance with hearing peers and does not appear to focus on meaningful patterns of development that occur across the DHH population.

Balancing the importance of neither overidentifying nor underidentifying these students continues to be a need in the field (Calderon, 1998; Krywko, 2014). Given the lower average reading performance of students who are DHH, many students may be inappropriately identified with an LD if the Individuals with Disabilities Education Act (IDEA) exclusionary criteria for DHH status were not in place. In contrast, a practitioner may be hesitant to diagnose an LD in a student who is DHH because of the difficulty in ruling out the student's hearing loss and reduced exposure to robust language and communication models as a primary cause of learning difficulties (Krywko, 2014). Examining trends in the achievement of DHH students in comparison to their hearing peers, however, does not directly address the problem of accurately diagnosing students who also have a co-occurring LD. Previous research has looked at qualitative characteristics, typically from the perspective of their teachers (Mauk & Mauk, 1998), that differentiate between students who are DHH with an LD and students who are DHH without an LD (Soukup & Feinstein, 2007), but no studies have compared the standardized achievement of these groups. A pattern of achievement differences between the two subgroups of students who are DHH may help educators better diagnose this population. The purpose of this paper is therefore to present exploratory findings regarding the academic achievement of national samples of students who are (a) classified with an LD, (b) DHH, and (c) DHH and classified with an LD. We analyzed standardized achievement data from the National Longitudinal Transition Survey 2 (NLTS2), focusing on measures of reading, language, and mathematics skills.

METHODS

We completed a secondary data analysis of a large national sample of high school–aged students who are DHH, students who are DHH and have an LD, and hearing students with an LD. We used data from Waves 1 and 2 (2001 and 2003) of the NLTS2 dataset. At the time of the first wave, students were between 13 and 16 years of age. The NLTS2 was commissioned by the U.S. Office of Special Education Programs to help investigate the experiences and achievements of students with disabilities during their transition from high school to adult life.

Students with an LD, students who are DHH, and students who are DHH and have an LD were the focus of this analysis (hereafter referred to as the *LD group*, *DHH group*, and *DHH–LD group*, respectively). Students with other co-occurring disabilities were excluded from this analysis to clearly differentiate between the performances of these groups without introducing other confounding variables. The NLTS2 assessors determined that some students in the overall sample were not cognitively or behaviorally able to complete the battery of direct assessments, which included standardized achievement tests. Because standardized achievement data were not available for these students, they were also excluded from our analyses. The total sample size for these analyses was 1,140 (n = 363 DHH only, n = 666 LD only, and n = 111 both DHH and LD). Note that all figures are rounded to the nearest tens as per Institute of Education Sciences policy for dissemination of restricted data.

Measures

The data from three subtests from the widely used Woodcock–Johnson Tests of Achievement III (WJ III) and one from the WJ III Tests of Cognitive Abilities were analyzed (Woodcock, McGrew, & Mather, 2001). The WJ III subtests included Passage Comprehension (assesses reading comprehension), Synonym–Antonym (measures language development), Calculation (assesses computation skills), and Applied Problems (assesses practical math problem-solving skills). Throughout testing, students were allowed to use the testing accommodations that were indicated in their Individualized Education Program plans developed under IDEA.

These WJ III subtests used in the NLTS2 were research editions, shorter adaptations of the full-length tests, and were developed for this specific use by the original authors of the WJ III. The average reliability across these tests was .65 (Wagner, Newman, Cameto, & Levine, 2005). Individual item data were not available from the NLTS2; therefore it was not possible to calculate the subtest reliabilities ourselves. The scores from these research subtests were on the same scale as the full-length tests and used the same national norms (M = 100, SD = 15). Scores between 85 and 115 are considered within the average range. The focus of these analyses was on scores within the below-average range, those 84 and below, because a below-average score on a standardized achievement test suggests a child is not achieving commensurate with others the child's age; such performance is part of the federal criteria for determining whether a student has an LD in a specific academic area (U.S. Department of Education, Office of Special Education Programs, 2006, p. 2). In addition, classroom grades, as reported by parents, were included in these analyses. Parents reported their children's overall secondary school grades. Nine response options were provided: 1 = As, 2 = As and Bs, 3 = Bs, 4 = Bs and Cs, 5 = Cs, 6 = Cs and Ds, 7 = Ds, 8 = Ds and Fs, and 9 = Fs.

Analysis

Because this dataset was designed to be nationally representative, students with an LD were weighted much more heavily than those who are DHH to reflect their respective prevalence in the United States. Applying the weights to these analyses would put an extreme emphasis on LD students despite our interest in students who are DHH; therefore we avoided using the sample weights. As such, these data should be regarded as a convenience sample. The implications of this decision are discussed in the Limitations and Future Research subsection. The Statistical Package for the Social Sciences (SPSS, version 21; IBM, 2012) was used to conduct all analyses.

Our analyses focused on descriptive statistics for the three groups, performance comparisons across the three groups using χ^2 tests,

Table 1. Student Characteristics

Variable	LD	DHH	DHH–LD
Gender			
Male	390 (60%)	160 (50%)	70 (60%)
Female	280 (40%)	200 (60%)	40 (40%)
Ethnic background			
White, non-Hispanic	370 (60%)	220 (60%)	70 (70%)
Hispanic	100 (20%)	60 (20%)	20 (20%)
African American	180 (30%)	70 (20%)	20 (10%)
Asian	10 (<10%)	20 (<10%)	10 (<10%)
American Indian or Alaska Native	10 (<10%)	0	0
Multiracial	0	0	
School setting			
Mainstream	620 (>90%)	220 (60%)	80 (70%)
Special school	20 (<10%)	120 (40%)	30 (30%)
Specialized subject area	0	0	0
Vocational	10 (<10%)	0	0
Charter	0	0	0
Alternative school	10 (<10%)	0	0
Language used at home			
English	580 (90%)	230 (60%)	70 (70%)
Spanish	60 (10%)	20 (<10%)	10 (10%)
Sign language	0	100 (30%)	20 (20%)
Classroom grades			
As and Bs	150 (30%)	150 (50%)	20 (30%)
Bs and Cs	180 (40%)	110 (40%)	30 (50%)
Cs and Ds	110 (20%)	40 (10%)	10 (20%)
Ds and Fs	20 (<10%)	0	0
Fs	0	0	0
Mean WJ III Synonym–Antonym score	82 (*SD* = 16)	84 (*SD* = 18)	72 (*SD* = 19)
Mean WJ III Passage Comprehension score	74 (*SD* = 20)	75 (*SD* = 23)	61 (*SD* = 24)
Mean WJ III Calculation score	80 (*SD* = 20)	93 (*SD* = 19)	78 (*SD* = 20)
Mean WJ III Applied Problems score	81 (*SD* = 17)	84 (*SD* = 18)	73 (*SD* = 21)

Note. Classroom grade categories were collapsed for simplicity purposes. Sample sizes and percentages were rounded to the nearest tens as per Institute of Education Sciences policy. DHH = deaf or hard of hearing; LD = learning disability; WJ III = Woodcock–Johnson Tests of Achievement III.

and a discriminant analysis between the DHH and DHH–LD groups. For the χ^2 analyses, the analytic goals were to compare the percentage of students in the three groups who fell below the average range threshold (scores of 84 and below) and to compare the number of below-average subtests across groups. The discriminant analysis included the WJ III subtests and classroom grades as predictors in differentiating between the DHH group and the DHH–LD group.

RESULTS

Demographic and Classroom Performance Differences Across Groups

Prior to examining differences across the groups according to their academic achievement, we also explored their demographic characteristics (Table 1). In this sample, the percentages across gender, ethnicity, school setting, and the language used at home were similar for students who are DHH and

Table 2. Comparisons of Subtests Below 85 Across Groups

	LD	DHH	DHH–LD	χ^2	Significance
Subtest					
Synonym–Antonym	50%	50%	80%	29.942	<.001
Passage Comprehension	70%	60%	80%	16.614	<.001
Applied Problems	50%	40%	70%	21.065	<.001
Calculation	60%	30%	60%	86.150	<.001
Number of subtests below cutoff					
0	20%	30%	10%	—	—
1	20%	20%	10%	—	—
2	20%	20%	10%	—	—
3	20%	20%	20%	—	—
4	30%	20%	40%	—	—
Mean number of subtests below cutoff	2.242	1.780	2.820	—	—

Note. Percentages were rounded to the nearest tens as per Institute of Education Sciences policy. DHH = deaf or hard of hearing; LD = learning disability.

those who are DHH and have an LD. There appeared to be preliminary differences across all three groups in their classroom performance and standardized achievement scores. These differences are further explored in the following subsections.

Differences Across Groups According to the Cutoff Criteria

The percentages of students across the three groups who scored <85 are presented in Table 2. In this table, a higher proportion means that students were more likely to score below average on the tests. Those in the DHH–LD group were much more likely than the other two groups to score below the cutoff on all subtests. Four separate χ^2 tests were run for each subtest to determine if there were significant differences between the groups. The results of each test were significant (see Table 2). The largest difference between the three groups was on the WJ III Calculation subtest, favoring the DHH group. Thirty percent of the DHH group scored <85 on the Calculation subtest, whereas 60% of the LD and DHH–LD groups scored below average.

Next, we summed the number of WJ III subtests <85 for each student. Table 2 displays the percentages of students from each group who scored below average on one, two, three, or all four tests. More students in the DHH–LD group scored below the cutoff on four tests (40%) in comparison to the other groups, and more students in the DHH group scored above the cutoff on all tests (30%). We analyzed this summed cutoff variable using three χ^2 tests to determine if, and between which groups, significant differences emerged. Each group was significantly different from all other groups. There was a significant difference between the DHH and DHH–LD groups in the number of tests below the cutoff, $\chi^2(4) = 43.66$, $p < .001$, with those in the DHH group outperforming those in the DHH–LD group. The DHH and LD groups significantly differed, $\chi^2(4) = 26.69$, $p < .001$, with the DHH group outperforming the LD group. Finally, the DHH–LD and LD groups significantly differed, $\chi^2(4) = 17.10$, $p = .002$, with the LD group outperforming the DHH–LD group.

Using a Pattern of Results to Distinguish Between the DHH and DHH–LD Groups

To describe the nature of the differences between the DHH and DHH–LD groups, we completed a discriminant analysis that focused only on these two groups. The goal of this analysis was to determine whether LDs among students who are DHH were predictable from the four WJ III tests and classroom grades. For this discriminant analysis, the predictors were entered in one step. The default classification method in SPSS is to classify equal proportions of students into each group regardless of actual group sizes. For this analysis, the classification method was based on the actual proportion of students in the DHH and DHH–LD groups because the group sizes were unequal (Warner, 2007).

Preliminary screening indicated that scores on the four WJ III tests and classroom grades were approximately normally distributed (absolute skewness ranged from 0.33 to 1.13 and kurtosis ranged from 0.03 to 2.11) and there were no concerns with multicollinearity (variance inflation factor <3). Several outliers were detected: There were 11 unusually low scores (i.e., three standard deviations from the mean) on the Applied Problems test, 4 low Synonym–Antonym scores, 2 high classroom grades, and 1 high Calculation score. Discriminant analyses were run with and without these 18 outliers. The results were similar; thus the outliers were included in the results presented herein. The assumption of homogeneity of within-group variance–covariance matrices was also tested via Box's *M* test, $F(15, 42047) = 0.968$, $p = .487$. The results of Box's *M* test did not suggest a violation of the assumption.

One discriminant function was created because there were two groups. The χ^2 for the discriminant function was statistically significant, $\chi^2(5) = 29.41$, $p < .001$. The discriminant function had a canonical correlation of .280. The squared canonical correlation indicates the proportion of variance in scores on the discriminant function that is associated with between-group differences (Warner, 2007). Thus, 8% of the variance in the discriminant function was associated with between-group differences, a small to moderate association (Ferguson, 2009). The results indicate that high scores on the discriminant function were associated with the DHH group and low scores with the DHH–LD group.

The standardized canonical discriminant function coefficients identified the two most important and heavily weighted predictors in determining the discriminant function, controlling for correlations with other predictors. The WJ III Calculation test was given the most weight (.78) followed by classroom grades (–.38; this variable was negatively scaled). These were the only predictors above a .35 cutoff. Therefore, students in the DHH group tended to score higher on the WJ III Calculation test and earn higher classroom grades than those in the DHH–LD group.

Overall, 84% of the students were correctly classified into the two groups by the discriminant function. The DHH group was correctly classified at a high rate, 99%. Only 5% in the DHH–LD group were correctly classified. In other words, the model predicted being DHH more accurately than being in the DHH–LD group.

Although the results suggest that the WJ III Calculation test and classroom grades were the most strongly related to the discriminant function, all the other predictors were significantly related to group membership when the other predictors were not controlled for. The group means for the WJ III Synonym–Antonym, Passage Comprehension, and Applied Problems tests varied significantly, favoring the DHH group, $F(1, 362) = 10.64$, $F(1, 362) = 7.29$, and $F(1, 362) = 8.66$, respectively, using Bonferroni correction, $p < .01$.

DISCUSSION

Although much literature has been devoted to examining the differences in performance observed between hearing students and students who are DHH (Mitchell & Karchmer, 2011; Qi & Mitchell, 2012; Traxler, 2000), little is known about test performance differences that differentiate students who are DHH with and without an LD. Furthermore, little research has examined the performance of DHH students on tests that are widely used in diagnosing LDs (Qi & Mitchell, 2012); comparisons have rarely been made between students who are DHH and students who are hearing and have an LD. Comparisons between these three groups using quantitative data are lacking in the field. It is critical to differentiate between students who are DHH and those who are DHH and have an LD to provide an appropriate learning environment, which may include academic interventions and accommodations (Krywko, 2014).

Our exploratory study examined quantitative data, incorporating frequently used standardized tests in the field, to make comparisons between hearing students with an LD, students who are DHH, and students who are DHH and have an LD. We found that students who are DHH tended to perform better on math calculation tasks than hearing students with an LD and students who are DHH with an LD. Performance on mathematics tasks, particularly those without a language component such as word problems, is less likely to be affected by a student's hearing loss and exposure to language models than performance on reading tasks. These findings suggest that math calculation scores may be an area where school psychologists more specifically focus their LD eligibility determinations. Although students who are DHH are likely to score below grade level in reading (Mitchell & Karchmer, 2011; Qi & Mitchell, 2012; Traxler, 2000), their reading performance is similar to their hearing peers with LDs.

Our results suggest a preliminary pattern, using WJ III tests and classroom grades, among students who are DHH that may help distinguish between those with an LD and those without an LD. Students who both are DHH and have an LD were significantly more likely than the other groups to score below average on several WJ III subtests. Thus, school psychologists may look for a consistent pattern of weaknesses in standardized testing data when determining if students who are DHH have an LD. Although classroom grades are often thought to be a more subjective measure of performance than standardized achievement scores, grades were also useful in differentiating between students who are DHH with an LD and students who are DHH without an LD.

Although this pattern of higher standardized math calculation performance is not surprising, school psychologists may feel more confident in diagnosing LDs in students who are DHH when low math performance is present, rather than if performance is only low in areas related to reading and language. To date, however, no studies have examined the pattern of results of students who are DHH using tests that are commonly used to diagnose LDs. Thus, our findings lend empirical support to these assumptions and are based on a large national dataset.

Limitations and Future Research

Several limitations influenced this study, and these limitations should be considered when interpreting the results. Unfortunately, it was not possible to verify the validity of the students' disability classifications. The procedures and decision-making processes that were used to originally classify students with or without LDs are unknown. Information from school records and parents was used in the NLTS2 to classify students according to their primary disability. Furthermore, the dataset did not allow for a more fine-grained analysis that focused on the particular academic area or areas affected by the students' LDs, such as basic reading skills, reading comprehension, and mathematics problem solving.

A few limitations related to our statistical analyses are worth noting. The Type I error rate may be inflated in this study because of the number of statistical tests. This is an exploratory analysis, however, with a large sample size. Also, we did not account for the possible clustering of students within schools. Students from the same school may have dependent error terms, thus violating the independence assumption. This violation may not be practically meaningful, however, because 400 of 420 schools had $<$10 students each in the sample. Multilevel analyses should be considered in future research with more strongly hierarchically structured data.

Another limitation was that the analysis was limited to the shortened, less reliable standardized tests administered in the NLTS2. This dataset did not allow us to analyze composites of students' reading and math performance, which are typically used in the field when determining if a student meets criteria for an LD. Thus, our analysis was more narrowly focused on the specific skills measured by individual subtests. Future research incorporating more comprehensive cognitive and achievement measures is needed. It is important to note that our exploratory study was not designed to determine the usefulness of the WJ III in diagnosing LDs in students who are DHH. Rather, these tests were used to explore the differences among students who are DHH with and without LDs and hearing students with LDs.

Although the WJ III tests and classroom grades were successful in distinguishing between students who are DHH with an LD and students who are DHH without an LD, much variation was left unexplained between the groups. These measures should be supplemented with other information to explain more of the variation between these two groups. For example, future research may incorporate nonverbal tests, which are particularly relevant to this population, and visual–motor integration measures (Morgan & Vernon, 1994).

Finally, the dataset did not provide detailed information about the communication proficiency of the students. Future research may include information about the ASL proficiency of students who are DHH and determine if this information helps distinguish between those with an LD and those without an LD. Controlling for other factors, it is likely that students with higher ASL proficiency will outperform those with less developed ASL skills academically (Freel et al., 2011; Strong & Prinz, 1997). Furthermore, LDs in sign language are another important, and emerging, area of research (Quinto-Pozos, Forber-Pratt, & Singleton, 2011) and warrant further exploration.

CONCLUSIONS

Our findings suggest test performance profiles to look for when educators are trying to determine whether a student who is DHH has a co-occurring LD. Educators may be more concerned if their student who is DHH struggles with math calculation and if there is a pattern of low scores across several standardized tests in a variety of areas (note that students with other disabilities, including cognitive disabilities, were not included in this study). In addition, the students' classroom grades may be another informative factor in the diagnostic process. In contrast, lower performance on only reading and vocabulary tests may not be suggestive of an LD for students who are DHH.

The results of our study were exploratory in nature, and this work represents an attempt to shift the perspective from merely comparing the performance of students who are DHH with their hearing peers to more accurately diagnosing the learning needs of students who are DHH. There is a great need for additional research to explore how to accurately identify students who are DHH who may benefit from educational supports. Research that incorporates data that school psychologists are most likely to use when determining if a student who is DHH meets criteria for an LD is lacking and is an important future research direction.

REFERENCES

Bat-Chava, Y. (2000). Diversity of deaf identities. *American Annals of the Deaf, 145*, 420–428.

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.* Retrieved from Special Education Elementary Longitudinal Study website: http://www.seels.net/designdocs/SEELS_HearingIImpairmentReport.pdf

Calderon, R. (1998). Learning disability, neuropsychology, and deaf youth: Theory, research, and practice. *Journal of Deaf Studies and Deaf Education, 3*, 1–3.

Cawthon, S., & the RES Team. (2012). *National needs assessment.* Retrieved from pepnet 2 website: http://pepnet.org/sites/default/files/NAMASTERCOMPILEDPDF.pdf

Convertino, C., Borgna, G., Marschark, M., & Durkin, A. (2014). Word and world knowledge among deaf learners with and without cochlear implants. *Journal of Deaf Studies and Deaf Education, 19*, 471–483. doi: 10.1093/deafed/enu024

Ferguson, C. J. (2009). An effect size primer: A guide for clinicians and researchers. *Professional Psychology: Research and Practice, 40*, 532–538.

Flanagan, D. P., Ortiz, S. O., & Alfonso, V. C. (2013). *Essentials of cross-battery assessment* (3rd ed.). New York, NY: Wiley.

Freel, B. L., Clark, M. D., Anderson, M. L., Gilbert, G. L., Musyoka, M. M., & Hauser, P. C. (2011). Deaf individuals' bilingual abilities: American Sign Language proficiency, reading skills, and family characteristics. *Psychology, 2*, 18–23.

IBM. (2012). *IBM SPSS Statistics for Windows (version 21.0)*. Armonk, NY: Author.

Krywko, K. (2014). Learning disabilities and hearing loss: Where does one end and the other begin? *Volta Voices, 21*, 14–17. Retrieved from http://listeningandspokenlanguage.org/uploadedFiles/Connect/Publications/Volta_Voices/VV_Mar-Apr_2014_v4.pdf

Mauk, G. W., & Mauk, P. P. (1998). Considerations, conceptualizations, and challenges in the study of concomitant learning disabilities among children and adolescents who are deaf or hard of hearing. *Journal of Deaf Studies and Deaf Education, 3*, 15–34. doi: 10.1093/oxfordjournals.deafed.a014337

Mitchell, R. E., & Karchmer, M. A. (2011). 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* (2nd ed., Vol. 1, pp. 18–31). New York, NY: Oxford University Press.

Morgan, A., & Vernon, M. (1994). A guide to the diagnosis of learning disabilities in deaf and hard-of-hearing children and adults. *American Annals of the Deaf, 139*, 358–370.

National Association of School Psychologists. (2012). *Students who are deaf or hard of hearing and their families* [Position statement]. Bethesda, MD: Author. Retrieved from http://www.nasponline.org/about_nasp/positionpapers/ServingStudentsWhoAreDeaf.pdf

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

Quinto-Pozos, D., Forber-Pratt, A. J., & Singleton, J. L. (2011). Do developmental communication disorders exist in the signed modality? Perspectives from professionals. *Language, Speech, and Hearing Services in Schools, 42*, 423–443.

Soukup, M., & Feinstein, S. (2007). Identification, assessment, and intervention strategies for deaf and hard of hearing students with learning disabilities. *American Annals of the Deaf, 152*, 56–62.

Strong, M., & Prinz, P. M. (1997). A study of the relationship between American Sign Language and English literacy. *Journal of Deaf Studies and Deaf Education, 2*, 37–46.

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

U.S. Department of Education, Office of Special Education Programs. (2006). *IDEA regulations: Identification of specific learning disabilities.* Retrieved from http://idea.ed.gov/explore/view/p/,root,dynamic,TopicalBrief,23,

Wagner, M., Newman, L., Cameto, R., & Levine, P. (2005). *The academic achievement and functional performance of youth with disabilities. A report from the National Longitudinal Transition Study-2 (NLTS2).* Menlo Park, CA: SRI International. Retrieved from National Longitudinal Study 2 website: www.nlts2.org/reports/2006_07/nlts2_report_2006_07_complete.pdf

Warner, R. M. (2007). *Applied statistics: From bivariate through multivariate techniques.* Thousand Oaks, CA: Sage.

Woodcock, R. W., McGrew, K. S., & Mather, N. (2001). *Woodcock-Johnson III.* Chicago, IL: Riverside.

Date Received: September 19, 2014
Date Accepted: July 7, 2015
Associate Editor: John Hitchcock ■

Jacqueline M. Caemmerer is a doctoral candidate in the school psychology program at The University of Texas at Austin and a graduate research assistant for Research and Evidence Synthesis at pepnet 2. Her research focuses are social and cognitive influences on students' achievement and psychological assessment.

Stephanie W. Cawthon is an associate professor in educational psychology at The University of Texas at Austin and Associate Director for Research and Evidence Synthesis at pepnet 2. Her research interests involve factors that increase education access for individuals who are deaf or hard of hearing, specifically surrounding issues of assessment and accommodations.

Mark Bond is a doctoral candidate in educational psychology at The University of Texas at Austin and a graduate research assistant for Research and Evidence Synthesis at pepnet 2. His research interests involve Bayesian model comparison using the Bayes factor and Bayesian latent growth modeling.