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Cognitive and Achievement Characteristics of Students From a National Sample Identified as Potentially Twice Exceptional (Gifted With a Learning Disability)

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Abstract

It is important to identify cognitive and achievement characteristics that differentiate students who are twice exceptional because they are gifted and have a learning disability (2e-LD) from gifted and average ability peers because this information informs empirically-based identification and support systems for this population. In this study, I classified school-age participants (N = 3,865) in the nationally representative standardization sample for the Woodcock-Johnson IV (WJ IV) Tests of Cognitive Abilities and Achievement as potentially gifted, 2e-LD, or of average ability based on their WJ IV performance. I compared mean levels of performance, strengths and weaknesses, and intraindividual heterogeneity across 2e-LD, gifted, and average-ability groups. The 2e-LD group demonstrated greater heterogeneity in performance, and their strengths and weaknesses were largely consistent with past research and writing on 2e-LD characteristics. Results support some 2e-LD identification recommendations from the literature and highlight the potential benefits of individualized assessment, dual differentiation, and a de-emphasis of speeded academic tasks.

Keywords

academic achievement, cognitive abilities, descriptive, giftedness, learning disabilities

Despite increased attention to twice-exceptional populations in recent decades, empirical research lags behind the needs of educators, families, psychologists, and researchers who strive to accurately identify and successfully support twice-exceptional students (Foley Nicpon, Allmon, Sieck, & Stinson, 2011). For example, there is limited empirical research on the key cognitive and achievement characteristics that differentiate students who are gifted and have a learning disability (2e-LD) from peers who are of average ability or who are gifted without a learning disability (LD), even though such information is critical to create empirically based identification and support systems for students who are 2e-LD. A number of studies have reported cognitive and achievement characteristics of 2e-LD samples (see Lovett & Sparks, 2011, for a review), but these studies often used different criteria to identify students as 2e-LD, which makes it difficult to compare results across studies or draw general conclusions about the characteristics and needs of the 2e-LD population. The primary goals of this study, therefore, are to describe the cognitive and achievement characteristics of students who have been identified as 2e-LD with standard criteria applied to a nationally representative sample and to compare these characteristics with those of students who are gifted and of average ability.

Cognitive Characteristics of Students Who Are 2e-LD

Students who are 2e-LD exhibit notable strengths and weaknesses in their cognitive profiles. Identification of giftedness is often based on superior overall intelligence or unusually high aptitude in one or more areas of cognitive functioning (Benbow & Minor, 1990; Gottfried, Gottfried, & Guerin, 2006; Hollinger & Kosek, 1986), and students who are 2e-LD demonstrate strengths in reasoning, verbal, or spatial abilities that are similar to those of their gifted peers without an LD (LaFrance, 1997; Steeves, 1983). For example, a synthesis of 46 studies on students identified as 2e-LD reported a weighted mean Full-Scale IQ (FSIQ) score in the Superior range (122.8) and weighted mean Verbal and Performance IQ scores in the High Average (118.6) and Superior (129.5) ranges, respectively (Lovett & Sparks, 2011).

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Students who are 2e-LD differ from gifted peers without an LD in that their cognitive gifts co-occur with cognitive processing deficits. Such deficits are a key characteristic of an LD and best practices for LD identification require students to demonstrate a cognitive processing deficit that is linked to performance in an area of low achievement (Hale et al., 2010). Research that delineates the links between processing abilities and academic achievement is often informed by Cattell–Horn–Carroll (CHC) theory, a well-validated and empirically supported model of human intellectual abilities (Schneider & McGrew, 2012). CHC theory proposes a hierarchical model of intelligence with a general intelligence factor, 8 to 10 broad cognitive abilities, and numerous more narrow abilities. Most modern, individually administered, multidomain tests of intelligence are based on CHC theory and measure CHC broad abilities such as crystallized knowledge, fluid reasoning, and processing speed as well as related narrow abilities and general intelligence. Students with an LD demonstrate a weakness at the broad- or narrow-ability level in aspects of processing speed, short-term or working memory, long-term memory and retrieval, or auditory processing. In turn, specific processing weaknesses are associated with impaired performance in specific areas of achievement but not others.

Interindividual Heterogeneity in Cognitive Abilities. Learning disabilities in different academic areas are associated with different cognitive weaknesses; therefore, there is no single cognitive profile for a student who is 2e-LD (Assouline, Foley Nicpon, & Whiteman, 2010). A thorough review of the processing abilities associated with each area of achievement is beyond the scope of this article, but a brief review illustrates some similarities and differences across different domains of academic impairment.

In previous research informed by CHC theory, processing speed, short-term/working memory, and long-term memory abilities have been associated with multiple areas of achievement, including decoding, reading comprehension, math problem solving, basic writing skills, and written expression (Evans, Floyd, McGrew, & Leforgee, 2002; Floyd, Evans, & McGrew, 2003; Floyd, McGrew, & Evans, 2008; Niileksela, Reynolds, Keith, & McGrew, 2016; see McGrew & Wendling, 2010, for a review). Processing speed is additionally associated with performance in reading fluency and math calculation (Niileksela et al., 2016). In the 2e-LD literature, authors have often highlighted processing speed and short-term/working memory, likely because of their widespread effects on achievement and because most past studies used the Wechsler scales, previous versions of which measured processing speed and short-term/working memory but not auditory processing or long-term memory and retrieval. Auditory processing abilities have a more narrow effect on achievement but are critical for the development of reading and writing skills. Dyslexia often involves weaknesses in phonological awareness, an aspect of auditory processing that supports decoding (Snowling, 2013), and retrieval fluency, or the ability to quickly retrieve information (such as sound–symbol relationships) from memory (e.g., van Viersen, Kroesbergen, Slot, & de Bree, 2014). As this brief review illustrates, multiple processing abilities affect each area of achievement; as a result, even a group of gifted students with LDs in the same domain (e.g., written language) can exhibit a wide range of scores—greater than two standard deviations—on measures of cognitive ability (Assouline et al., 2010).

Intraindividual Heterogeneity in Cognitive Abilities. In addition to cognitive differences *among* students who are 2e-LD, the 2e-LD population also exhibits more *intra*individual heterogeneity in cognitive abilities than gifted individuals without an LD (Assouline et al., 2010; Waldron & Saphire, 1990). Students who are 2e-LD by definition exhibit discrepancies between their cognitive gifts and cognitive processing weaknesses. Research has documented large, statistically significant discrepancies between reasoning and processing abilities and a wide range of cognitive scores among students who are 2e-LD even though many studies have not explicitly required students to demonstrate a cognitive processing deficit (Lovett & Sparks, 2011). For example, students who are gifted with a reading disability perform significantly worse than gifted peers without an LD on measures of visual discrimination, spatial ability, auditory discrimination, and auditory memory (Waldron & Saphire, 1992) and have significant weaknesses in memory, rapid automatic naming (a measure of long-term retrieval fluency), and phonological awareness that are similar to the weaknesses of nongifted dyslexic peers (Steeves, 1983; van Viersen et al., 2014), even though their IQ scores are in the gifted range (e.g., 132.50; van Viersen et al., 2014). Children with superior intelligence and an LD diagnosis often earn scores on measures of processing speed and working memory that are one to three standard deviations lower than their scores on verbal measures (Assouline et al., 2010; Schiff, Kaufman, & Kaufman, 1981). This study will be the first to quantify 2e-LD cognitive discrepancies in a representative sample.

In addition to their defining contrast between cognitive gifts and processing weaknesses, students who are 2e-LD may have more isolated cognitive strengths than gifted individuals without an LD (Schiff et al., 1981). Even gifted individuals without an LD have large score discrepancies among their fluid, verbal, and spatial reasoning ability scores more often than do nongifted individuals (Benbow & Minor, 1990; Hollinger & Kosek, 1986; Silver & Clampit, 1990; Sweetland, Reina, & Tatti, 2006; Wilkinson, 1993). These ability tilts in favor of certain cognitive gifts appear educationally and clinically meaningful because they predict gifted individuals' favorite high school and college courses, achievement of advanced degrees in specific fields, and ultimate career choices (Lubinski & Benbow, 2006; Shea, Lubinski, & Benbow, 2001). Such ability tilt discrepancies may be more extreme and more common among students who are 2e-LD (LaFrance, 1997), but little research has compared these discrepancies in gifted and 2e-LD populations.

In light of the cognitive weaknesses and discrepancies documented in the performance of students who are 2e-LD, many have argued that full-scale intelligence scores underestimate the verbal and reasoning strengths of students who are 2e-LD and thereby mask their cognitive giftedness (e.g., Assouline et al., 2010; Maddocks, 2018). For example, Assouline et al. (2010) found that the average FSIQ score among a group of students identified as 2e-LD was 1 standard deviation below the average Verbal Comprehension Index (VCI) score and almost 1 standard deviation below the average General Ability Index (GAI) score because students' processing speed and working memory scores were in the Average range overall and depressed their FSIQ. Such findings have led many to argue an FSIQ should not be used as the primary cognitive measure for 2e-LD identification. Recently, the National Association for Gifted Children (NAGC) released a position statement on gifted identification with the Wechsler Intelligence Scale for Children–Fifth edition (WISC-V) and recommended practitioners use any index score focused on verbal or reasoning abilities to identify students as gifted or twice exceptional (NAGC, 2018). This recommendation was based on the finding that gifted youth often have large discrepancies among index scores that can make the FSIQ summary score statistically uninterpretable. The recommendations from the position statement have not yet been evaluated with a 2e-LD sample.

Academic Achievement of Students Who Are 2e-LD

Many gifted individuals who are not twice exceptional excel on standardized academic tasks and in applied academic or creative pursuits throughout their education and in their careers (Gottfried et al., 2006; Hernandez Finch, Speirs Neumeister, Burney, & Cook, 2014; Lubinski & Benbow, 2006; Makel, Kell, Lubinski, Putallaz, & Benbow, 2016). In contrast, students who are 2e-LD by definition struggle in at least one academic area affected by their disability and often demonstrate overall poorer academic performance than non-LD gifted peers despite similar cognitive strengths (Assouline et al., 2010; Foley Nicpon et al., 2011). For example, Lovett and Sparks's (2011) research synthesis on students who are 2e-LD reported weighted mean academic scores in the Average or High Average range—95.8 for reading, 111.1 for math, and 93.0 for written language—despite a weighted mean FSIQ score in the Superior range (122.8).

There has been less research about the academic performance of students who are 2e-LD than about their cognitive performance despite the integral role of poor academic performance in 2e-LD referral and identification. Some research suggests that students who are gifted or 2e-LD tend to perform relatively worse on academic tasks that focus on memorization or speed (such as word recognition, math facts, or spelling) than on tasks that involve reasoning or application (such as reading comprehension or mathematical problem solving) and that such performance discrepancies are more exaggerated among students who are 2e-LD (Gilman et al., 2013; Maddocks, 2018), likely due to their processing weaknesses.

A focus on lower mean academic scores among students who are 2e-LD, however, may obscure considerable heterogeneity in students' performance and mask the presence of academic strengths. Students who are 2e-LD tend to perform variably across academic domains and can excel in domains that are less affected by their disability (Gilman et al., 2013; McCallum et al., 2013; Steeves, 1983). Maddocks (2018) found that between 28.0% and 59.4% of individuals identified as potentially 2e-LD using an ability-achievement discrepancy earned at least one academic score above 130, compared with only 16.9% of all students in a representative sample. In another study, students who were identified as potentially gifted in reading with a weakness in math performed in the Superior range (123) on a reading assessment despite Average performance on a math assessment (94; Bell, Taylor, McCallum, Coles, & Hays, 2015). Similarly, Gilman et al. (2013) profiled a student with a discrepancy of 2.47 standard deviations between her Superior-level performance on a math assessment (130) and Average-level performance on assessments of reading (93) and writing (93). These results suggest that many students who are 2e-LD require advanced programming in areas where they excel compared with same-age peers.

A focus on overall 2e-LD academic performance also obscures the fact that students who are 2e-LD vary considerably from one another in terms of their academic strengths and weaknesses. In Lovett and Sparks's (2011) synthesis, for example, the range of 2e-LD achievement means across studies highlights interindividual variability in performance: mean scores across samples ranged from 89.8 to 114.1 for reading; from 95.1 to 118.0 for math, and from 90.3 to 99.3 for writing/spelling. Gifted students often demonstrate a wide range of academic performance as well (e.g., Hernandez Finch et al., 2014; Maddocks, 2018), but results from the quantitative synthesis suggest more variability in achievement among students who are 2e-LD. For example, two students highlighted by Maddocks (2018) qualified as 2e-LD with the same set of criteria but exhibited contrasting achievement patterns. One student earned a score of 164 (Very Superior) for Reading Comprehension and a score of 109 (Average) for Math Calculation, whereas the other student earned a score of 113 (High Average) for Reading Comprehension and a score of 165 (Very Superior) for Math Calculation. These students illustrate the potential for wide discrepancies in achievement among students identified as 2e-LD.

2e-LD Identification Criteria

One hindrance to research on 2e-LD characteristics has been the extensive debate about appropriate 2e-LD identification criteria. The criteria used to define any exceptional group are subject to debate given that such criteria are always arbitrary to some degree, and in turn the characteristics of any group are influenced by the group's identification criteria. Nonetheless, identification criteria can be based on empirical research, and the implications of specific criteria can be empirically evaluated. Therefore, a secondary goal of this study is to evaluate a specific set of 2e-LD identification criteria informed by empirical research.

Recently, Maddocks (2018) evaluated the validity and utility of several 2e-LD identification criteria used in the literature and determined that criteria focused solely on a discrepancy between ability and achievement overidentified LDs in gifted youth. For example, 69.9% of students with a general intelligence score of 130 or higher also had a discrepancy of at least 1.5 standard deviations (22.5 points) between their general intelligence score and at least one area of achievement. Maddocks suggested that future research test a process to classify students in a large data set as potentially 2e-LD if they met a combination of normative and discrepancy-based criteria—normatively high performance on an indicator of potential giftedness, a discrepancy between ability and achievement or between two areas of achievement (e.g., Bell et al., 2015; McCallum et al., 2013), and normatively low performance in one area of processing. Maddocks (2018) suggested that in situations where cognitive processing evaluations are difficult or time-consuming to obtain, such as school practice, students who met the other screening criteria could be selected for follow-up cognitive testing if they performed in the average range or lower academically. The suggestion to combine discrepancy-based and normative criteria is aligned with recommendations by the Learning Disabilities Association of American (Hale et al., 2010) and experts on twice exceptionality (Reis, Baum, & Burke, 2014) but has not yet been empirically tested for 2e-LD identification. In this study, I used a set of identification criteria based on the recommendations in Maddocks (2018) to determine the type of students who are labeled potentially 2e-LD by these specific criteria and to determine whether the criteria demonstrate adequate validity.

Purpose of the Study

Information about the nature, magnitude, and range of cognitive and academic strengths and weaknesses among students who are 2e-LD may help educators and psychologists more accurately recognize, identify, advocate for, and support these students. The overarching research questions were: What are the cognitive ability and academic achievement characteristics of students identified as potentially 2e-LD and how do these characteristics compare with those of students identified as potentially gifted and of average ability? Specifically, I focused on mean levels of performance, strengths and weaknesses, and measures of intraindividual variability because these topics are often discussed in the literature on students who are 2e-LD. Because identification criteria inevitably create selection effects and some predictable differences across groups, I sought to examine aspects of 2e-LD cognitive and academic performance that were neither self-evident nor guaranteed by the identification criteria and that may be relevant for 2e-LD identification and programming. For example, were weaknesses more prevalent in some processing abilities and academic areas than others? Did the students identified as 2e-LD also exhibit processing and academic strengths? What magnitudes of intra-individual discrepancies were typical among students classified as potentially 2e-LD? No previous research has examined these patterns or questions in a representative 2e-LD sample. With a representative sample, it is easier to minimize some 2e-LD selection effects that may have affected previous studies such as varied identification processes, biases in referral, differential parent advocacy, or socioeconomic differences in access to assessment.

I also sought to provide more detailed information about cognitive and academic performance than many past studies of students who are 2e-LD. Most previous studies have used a version of the Wechsler scales (see Lovett & Sparks, 2011) that provided scores for only four or five CHC broad cognitive abilities, and unmeasured abilities such as auditory processing and long-term retrieval play an important role in specific areas of achievement (McGrew & Wendling, 2010). The cognitive assessment measure used in this study provides information about eight broad cognitive abilities that are frequently measured in clinical and school practice. Additionally, only six studies reviewed in Lovett and Sparks's (2011) 2e-LD synthesis measured academic achievement, and they often reported broad measures of reading, math, or writing achievement even though LDs are typically identified in more specific subdomains (e.g., basic reading, reading comprehension; Flanagan, Ortiz, & Alfonso, 2013). Therefore, I examined 2e-LD achievement in narrower subdomains as well as several summary achievement scores.

A secondary research question was, do identification criteria based on suggestions in Maddocks (2018) demonstrate reasonable validity? Specifically, I examined the identification rate associated with the criteria and whether the cognitive and achievement patterns of the identified students aligned with past research.

Method

Data were drawn from the nationally representative standardization sample for the co-normed Woodcock-Johnson IV (WJ IV) Tests of Cognitive Abilities (COG) and Achievement (ACH). The school-age portion of the sample contains 3,865 K-12 students and is representative of the United States

Table 1. Definitions of CHC Broad Cognitive Abilities.

Cognitive ability	Definition
Fluid reasoning (Gf)	The deliberate, flexible control of attention to solve novel problems that cannot be solved with previously learned strategies or schema
Comprehension-knowledge (Gc)	The breadth and depth of acquired knowledge from one's culture, including vocabulary and general information
Processing speed (Gs)	The ability to perform repetitive cognitive tasks quickly and fluently
Short-term working memory (Gwm)	The ability to encode, temporarily store, and actively review or manipulate information in one's immediate awareness
Auditory processing (Ga)	The ability to detect and process meaningful nonverbal information in sound
Long-term storage and retrieval (Glr)	The ability to store, consolidate, and retrieve information over minutes, hours, days, and years
Visual processing (Gv)	The ability to make use of mental visual imagery and visual memory to solve problems

Note. CHC = Cattell–Horn–Carroll theory.
Source. Adapted from Schneider and McGrew (2012) and McGrew et al. (2014).

school-age population in terms of sex, race, Hispanic ethnicity, region of the country, country of birth (the United States or other), community type, type of school, and parent education levels. The technical manual provides detailed information to support the content, construct, and concurrent validity of the WJ IV (McGrew, LaForte, & Schrank, 2014). I selected the WJ IV for this study instead of the Wechsler scales because the WJ IV has a large co-normed sample and measures a wide range of cognitive and achievement constructs consistent with CHC theory. Age-standardized scores on the WJ IV have a mean of 100 and a standard deviation of 15. Descriptive score ranges provided in the manual are Very Low (69 and below), Low (70-79), Low Average (80-89), Average (90-110), High Average (111-120), Superior (121-130), and Very Superior (131+).

Measures

Cognitive measures included seven CHC broad cognitive ability scores from the WJ IV COG: fluid reasoning, comprehension-knowledge (a measure of verbal abilities), processing speed, short-term working memory, auditory processing, long-term storage and retrieval, and visual processing (Mather & Wendling, 2014b; McGrew et al., 2014). See Table 1 for descriptions of the broad abilities. Additionally, the General Intellectual Ability (GIA) composite score represents general intelligence, is similar to an FSIQ score, and correlates strongly (r = .86) with the Wechsler Intelligence Scale for Children–Fourth edition (WISC-IV) FSIQ (McGrew et al., 2014). The fluid reasoning/comprehension-knowledge composite also has a high loading on a general intelligence latent factor and correlates strongly with the WISC-IV FSIQ (r = .83) but is conceptually more similar to the Wechsler GAI because it does not include measures of processing speed or working memory.

Achievement measures were 10 cluster scores from the WJ IV ACH (Mather & Wendling, 2014a). Seven of the scores reflect achievement in specific academic subdomains that are relevant to identification of an LD (Flanagan et al., 2013). Basic Reading Skills measures phonics and decoding skills. Reading Comprehension measures comprehension of words and short passages. Reading Fluency measures reading speed and accuracy. Math Calculation measures basic calculation skills, and Math Problem Solving measures mathematical knowledge and reasoning. Basic Writing Skills assesses spelling and editing, and Written Expression assesses skills for writing simple to complex sentences. Three summary measures reflect aspects of academic performance across reading, math, and writing: Academic Skills summarizes performance on academic tasks that require memorization and basic task mastery, Academic Applications summarizes students' ability to apply academic skills to more complex tasks, and Academic Fluency summarizes performance on speeded tasks. See Table 2 for a list of the subtests that contribute to each achievement cluster score. Note that the Math Calculation and Written Expression clusters both include a test of fluency.

Identification Criteria to Form Gifted, 2e-LD, and Average-Ability Groups

I classified students as potentially gifted if they earned a score of 120 or higher on the GIA, fluid reasoning/comprehension-knowledge composite, comprehension-knowledge, or fluid reasoning measures. These specific scores align with Wechsler scores used for 2e-LD identification in most previous studies (Lovett & Sparks, 2011). As described above, the GIA is similar to the FSIQ, and the fluid reasoning/comprehension-knowledge composite is similar to the GAI. The comprehension-knowledge score is similar to the WISC-IV VCI (r = .79; McGrew et al., 2014), and the fluid reasoning score is similar to the WISC-IV perceptual reasoning index (PRI; r = .70). The WISC-IV PRI measures both fluid reasoning and visual processing (Keith, Fine, Taub, Reynolds, & Kranzler, 2006), but I did not use the WJ IV visual processing score to identify cognitive giftedness in this study

Table 2. Subtests for Each Academic Achievement Cluster Score.

Achievement cluster	Subtests
Basic Reading Skills	Letter-Word Identification, Word Attack
Reading Comprehension	Passage Comprehension, Reading Recall
Reading Fluency	Oral Reading, Sentence Reading Fluency
Math Calculation Skills	Calculation, Math Facts Fluency
Math Problem Solving	Applied Problems, Number Matrices
Basic Writing Skills	Spelling, Editing
Written Expression	Writing Samples, Sentence Writing Fluency
Academic Skills	Letter-Word Identification, Calculation, Spelling
Academic Fluency	Sentence Reading Fluency, Math Facts Fluency, Sentence Writing Fluency
Academic Applications	Passage Comprehension, Applied Problems, Writing Samples

because the WJ IV visual processing score does not measure visual *reasoning* (McGrew et al., 2014) and is only moderately correlated with the PRI ($r = .55$). There is no consensus about the best cutoff score to identify giftedness in large research samples, and I used a cutoff score of 120 because this cutoff has been used in past research with 2e-LD samples (see Lovett & Sparks, 2011) and provided a sufficiently large sample.

I then classified some of the students who met the giftedness criterion as potentially 2e-LD if they met two additional criteria, based on recommendations in Maddocks (2018):

1. Evidence of intraindividual academic impairment—specifically, a discrepancy ≥1.5 standard deviations between the gifted-level cognitive ability score and at least one academic cluster score frequently used for LD identification (i.e., Basic Reading Skills, Reading Comprehension, Reading Fluency, Math Calculation, Math Problem Solving, Basic Writing, or Written Expression). Ability-achievement discrepancies between 1 and 1.75 standard deviations have often been used for 2e-LD identification in research (Lovett & Sparks, 2011).
2. Evidence of an absolute processing deficit—specifically, a below-average score (<90) for processing speed, short-term working memory, long-term retrieval, or auditory processing. These processing abilities are consistently associated with one or more areas of academic performance (see McGrew & Wendling, 2010, for a review) and deficits in these abilities are considered a core feature of an LD because such deficits undermine learning in related achievement domains, as reviewed above. An LD cannot be definitively diagnosed from the limited information in this data set, but this criterion increases the likelihood that each individual's ability-achievement discrepancy (Criterion 1) is due to an LD and not simply due to regression to the mean (Carrigan, Carberry, Maddocks, & Keith, 2018) or factors such as low motivation or inadequate instruction (McCoach, Kehle, Bray, & Siegle, 2001). I did not include the visual processing score in this criterion because the WJ IV visual processing score is typically unrelated to academic performance and therefore not considered relevant for identification of an LD because deficits in visual processing as measured by the WJ IV do not compromise academic performance (Flanagan et al., 2013; McGrew & Wendling, 2010).

It is important to note that these 2e-LD identification criteria guaranteed that the cognitive ability profile of the 2e-LD group would be consistent with the 2e-LD cognitive profile described in the literature, in which strong reasoning or verbal abilities coexist with deficits in processing speed, working memory, or other processing abilities. Finally, I classified students as potentially of average ability if their GIA score was within 1 standard deviation of the test mean of 100 (i.e., 85-115), they did not have a significant discrepancy (1.5 standard deviations) between their GIA score and the seven specific academic clusters, and they were not classified as either gifted or 2e-LD.

Group Comparisons

First, I used chi-square tests to examine potential group differences in gender, race, Hispanic ethnicity, and parent education level. For significant omnibus chi-square results, I used a Fisher exact approach with a Bonferroni correction to compare standardized residuals across groups while controlling the family-wise error rate (Shan, n.d.; Shan & Gerstenberger, 2017). Next, I examined the normality and variance of the cognitive and achievement variables to determine the appropriate statistical tests to compare means across groups. In the gifted group, the fluid reasoning/comprehension-knowledge composite, processing speed, and visual processing scores exhibited significant positive skew ($p < .01$) as did Basic Reading Skills, Math Calculation, and Academic Skills. The fluid reasoning score exhibited significant negative skew. The GIA, fluid reasoning/comprehension-knowledge composite, and fluid reasoning scores were leptokurtic. In the 2e-LD group, the fluid reasoning/

comprehension-knowledge composite, fluid reasoning, and comprehension-knowledge scores demonstrated significant negative skew, and Written Expression was leptokurtic. The average-ability group displayed positive skew for most academic variables and significant kurtosis on the gifted cognitive criteria. I used Levene's test to compare variance in cognitive and achievement variables across groups, and the test was significant for multiple variables (see Results section for details).

Due to these violations of the assumptions of normality and homogeneity of variance as well as differences in group size, analysis of variance was not appropriate for mean comparisons. Instead, I used Welch's F test to compare mean 2e-LD, gifted, and average-ability scores, and I used the Games–Howell post hoc test to examine differences between groups while accounting for differences in sample size and variance. Next, I used frequency analyses to determine the percentage of students in each group who earned scores below average (<90), above average (>110), 120 or higher (120+; top 10%), and 130 or higher (130+; top 2%) on each variable. These results complement the mean score information, provide information about interindividual heterogeneity in each group, and illustrate specific strengths and weaknesses that may be obscured by mean scores. Because gifts and disabilities operate at the individual level and not at the group level, it was also important to examine total indicators of giftedness and disability within individuals (see Maddocks, 2018). To do so, I calculated the percentage of students in each group who demonstrated certain indicators of academic talent (at least one academic score 120+ or 130+) and LD-related deficits (at least one academic or processing score below average).

I then calculated intraindividual discrepancies between certain cognitive scores and converted these discrepancies to absolute values to examine hypothesized aspects of 2e-LD cognitive abilities: between fluid reasoning and comprehension-knowledge to examine ability tilt; between the GIA and fluid reasoning/comprehension-knowledge composite to examine depression of a FSIQ score; and between each of the primary gifted scores (fluid reasoning/comprehension-knowledge, fluid reasoning, and comprehension-knowledge) and processing speed and short-term working memory, to quantify the discrepancy between cognitive gifts and processing weaknesses. I focused on processing speed and short-term working memory for this analysis because these processing abilities affect most areas of achievement (Flanagan et al., 2013; McGrew & Wendling, 2010) and are often highlighted in the 2e-LD literature, as described above. The absolute discrepancy values demonstrated significant skew and heterogeneity of variance across groups as well as significant kurtosis for the average-ability group and some gifted/2e-LD discrepancies, so again Welch's F test and Games–Howell post hoc tests were used to compare means. Below, the results of these analyses are discussed in relation to group formation and the cognitive and academic characteristics of students classified as 2e-LD.

Results

Criteria identified 683 students (17.7%) as potentially gifted and 99 students as potentially 2e-LD, which accounts for 2.6% of the total sample and 12.7% of all students identified as potentially gifted. Only six of the students classified as 2e-LD earned a GIA score of 120 or higher; the majority were identified based on a high fluid reasoning/comprehension-knowledge composite, fluid reasoning, or comprehension-knowledge score. The criteria identified 1,901 students (49.2%) for the average-ability comparison group.

Table 3 lists demographic information for each group and the total sample. All three groups had similar proportions of males and females. The gifted group included significantly fewer students who were Black ($p < .001$) or Hispanic ($p = .002$) and more students who were Asian/Pacific Islander ($p = .002$) or non-Hispanic ($p = .002$). During test development, items in the WJ IV were reviewed for potentially biased content by a panel of experts and were tested for differential item functioning (DIF; a quantitative measure of test bias) across male/female, White/non-White, and Hispanic/non-Hispanic participants. Items identified as potentially biased for any group were reviewed and either removed from the test or retained if the apparent DIF could not be explained by item content and was primarily due to unusual responding by members of one subgroup. Therefore, it seems unlikely that the demographic differences across groups are due to WJ IV test bias. Furthermore, the demographic differences noted here are mostly consistent with previous research findings that African American and Latino students are consistently underidentified in gifted programs and Caucasian and Asian American students are often overidentified compared with population proportions (e.g., Esquierdo & Arreguín-Anderson, 2012; McBee, 2010; Yoon & Gentry, 2009). The average-ability group included significantly more students who were Black ($p < .001$) or Hispanic ($p = .008$) as well as fewer students who were non-Hispanic ($p = .008$). Students in the gifted group were more likely to have parents who obtained education beyond high school ($p < .001$) and less likely to have parents with a high school education ($p < .001$) or less ($p = .001$); students in the average-ability group showed the opposite pattern of parental education (all ps $< .001$). No significant differences across groups were due to differences in the 2e-LD demographics.

Table 4 displays descriptive statistics for cognitive and academic variables. Table 5 shows the percentage of students in the gifted, 2e-LD, and average-ability groups who earned scores that were below average, above average, 120+, and 130+ for each cognitive ability and academic area. Table 6 shows the percentage of students in the total sample and each group who earned at least one score indicative of academic talents or LD-related deficits. Table 7 displays descriptive statistics for the absolute discrepancies between different

Table 3. Demographic Percentages for the Total Sample and Each Group.

Characteristic	Total sample (N = 3,865)	Gifted (n = 683)	2e-LD (n = 99)	Avg-ab (n = 1,901)
Gender				
Male	49.6	50.5	58.6	47.1
Female	50.4	49.5	41.4	52.9
Race				
White	78.4	83.5	77.8	79.9
Black	14.0	7.0	14.1	13.3
Asian/Pacific Islander	4.5	7.2	3.0	4.2
American Indian	0.7	0.9	1.0	0.6
Other	2.3	1.5	4.0	2.1
Hispanic ethnicity				
Non-Hispanic	82.0	87.7	81.8	82.8
Hispanic	18.0	12.3	18.2	17.2
Parents' highest level of education				
Greater than a high school diploma	56.3	74.1	53.5	57.2
High school diploma or equivalent	30.3	18.7	38.4	31.0
Less than a high school diploma	12.9	7.0	8.1	11.6
Missing	0.3	0.1	0.0	0.3
Region				
Northeast	16.9	16.7	18.2	18.5
Midwest	25.4	23.9	33.3	23.3
South	32.0	30.2	25.3	32.9
West	25.7	29.3	23.2	25.4
Community size				
Metro	85.5	86.2	81.8	85.6
Micro	9.4	8.8	14.1	9.5
Rural	5.0	5.0	4.0	4.8

Note. 2e-LD = gifted with a learning disability; Avg-ab = average-ability.

cognitive abilities for each group. Below, I summarize the results in Tables 4 to 7 to describe the cognitive and academic characteristics of the 2e-LD group, both on its own and in comparison with the gifted and average-ability groups. I focus on mean levels of performance, individual strengths and weaknesses, and measures of intraindividual variability.

Cognitive Characteristics

Consistent with the criteria used to identify potential giftedness, the 2e-LD and gifted groups both earned mean scores in the High Average range for measures of verbal abilities and fluid reasoning, and few students in either group earned below-average scores for comprehension-knowledge (4.0% and 1.5%, respectively) or the fluid reasoning/comprehension-knowledge composite (1.0% and 0%). Overall, however, results suggested more isolated cognitive strengths among the students classified as 2e-LD than among their gifted counterparts without an LD, with a tendency toward verbal strengths. The 2e-LD group's comprehension-knowledge score (117.21) was equivalent to that of the gifted group (117.41), and a greater proportion of the 2e-LD group than the gifted group earned comprehension-knowledge scores of 120 or higher. For the other gifted identification criteria, however, the 2e-LD group earned lower mean scores and fewer scores above average or above 120 or 130 than the gifted group (see Tables 4 and 5). Additionally, 13.1% of the 2e-LD group earned below-average scores for fluid reasoning. The mean discrepancy between verbal abilities and fluid reasoning was approximately 1.5 standard deviations (23.74 points) for the 2e-LD group, compared with approximately 1 standard deviation (16.62 points) for the gifted group.

For cognitive processing abilities, the 2e-LD group earned equivalent scores to the average-ability group (and in the Average range) for short-term working memory, auditory processing, and long-term retrieval. Compared with both other groups, a higher percentage of students classified as potentially 2e-LD earned below-average scores for these processing abilities, likely due to selection effects and the 2e-LD identification criterion that required a processing deficit. Unlike the average-ability group, however, the processing performance of the 2e-LD group was marked by heterogeneity. First, the standard deviations of these processing abilities were qualitatively higher for the 2e-LD group (15.13-17.35) than the other groups (12.00-13.18). The results in Table 5 also indicate that students in the 2e-LD group exhibited absolute strengths in some processing abilities; a higher percentage of these students earned scores

Table 4. Means and Standard Deviations for Cognitive and Achievement Variables by Group.

Score	Gifted (*n* = 683)		2e-LD (*n* = 99)		Avg-ab (*n* = 1,901)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Cognitive ability						
GIA	119.68$_a$	8.73	104.98$_b$	9.40	99.51$_c$	7.80
Gf-Gc composite	120.68$_a$	8.49	115.76$_b$	8.44	99.46$_c$	7.74
Fluid reasoning	117.72$_a$	11.81	110.14$_b$	15.72	99.66$_c$	9.23
Comprehension-knowledge	117.41$_a$	12.89	117.21$_a$	13.68	99.30$_c$	9.73
Processing speed	111.41$_a$	12.62	94.58$_b$	14.83	100.07$_c$	12.90
Short-term working memory	115.19$_a$	12.00	101.40$_b$	15.13	100.25$_b$	12.17
Auditory processing	113.97$_a$	12.25	102.93$_b$	16.22	99.49$_b$	12.45
Long-term retrieval	112.18$_a$	13.00	101.16$_b$	17.35	100.17$_b$	13.18
Visual–spatial processing	110.98$_a$	14.63	100.18$_b$	13.09	100.57$_b$	13.88
Achievement area						
Basic Reading Skills	114.71$_a$	13.12	105.25$_b$	14.33	101.16$_c$	11.54
Reading Comprehension	115.23$_a$	12.65	104.93$_b$	11.40	101.38$_c$	11.34
Reading Fluency	114.48$_a$	13.10	101.51$_b$	11.70	101.11$_b$	11.71
Math Calculation Skills	115.15$_a$	13.26	102.88$_b$	12.32	101.30$_b$	11.28
Math Problem Solving	116.64$_a$	11.27	109.21$_b$	11.67	100.82$_c$	10.58
Basic Writing Skills	114.95$_a$	12.49	104.75$_b$	13.16	100.84$_c$	11.23
Written Expression	113.79$_a$	14.34	98.16$_b$	13.52	102.06$_c$	12.08
Academic Skills	116.17$_a$	12.26	105.63$_b$	11.70	101.03$_c$	10.55
Academic Applications	118.14$_a$	11.79	107.37$_b$	11.22	101.72$_c$	10.70
Academic Fluency	113.82$_a$	12.51	99.54$_b$	12.50	100.97$_b$	11.52

Note. 2e-LD = gifted with a learning disability; Avg-ab = average-ability; GIA = General Intellectual Ability; Gf-Gc composite = fluid reasoning/comprehension-knowledge composite. Means with different subscripts are significantly different based on Games–Howell post hoc tests. *p*s < .009.

above average and above 120 or 130 for the same processing abilities compared with the average-ability group—2 to 6 times higher for scores of 120+ and 130+.

In contrast, the 2e-LD group demonstrated more widespread deficits in processing speed. Almost half (48.5%) of the 2e-LD group earned a processing speed score that was below average, and the 2e-LD mean processing speed score was lower than that of both comparison groups. The discrepancies between cognitive gifts and processing speed were approximately 1.5 standard deviations (22.16-25.97) for the 2e-LD group compared with less than 1 standard deviation for both comparison groups (11.66-14.80; see Table 7).

Overall, the 2e-LD group displayed more variability in cognitive performance than the comparison groups. According to Levene's test, the three groups had statistically significantly different levels of variability for all cognitive variables except the GIA, fluid reasoning/comprehension-knowledge, and visual processing scores. Consistent with the selection criteria, the 2e-LD group's scores had more variance than the other groups. The mean discrepancy values displayed in Table 7 also differed significantly across all three groups, 2e-LD > gifted > average ability, with some differences between the 2e-LD and gifted groups exceeding 1 standard deviation. Mean 2e-LD discrepancies among cognitive abilities ranged from 11.38 to 25.97. The standard deviations for all cognitive discrepancy scores were also larger in the 2e-LD group, which indicates greater interindividual variability in discrepancy magnitude in addition to larger discrepancy magnitude overall. Perhaps due to such large discrepancies among cognitive scores, the mean GIA score for the 2e-LD group (104.98) was in the Average range and significantly lower than the GIA score for the gifted group even though individuals in both groups met the same gifted criteria.

Academic Characteristics

On the achievement measures, the 2e-LD group earned mean scores in the Average range for all domains, and all scores were significantly lower than the gifted group's mean scores in the High Average range; this relatively poorer performance by the 2e-LD group is expected given the identification criteria that required a discrepancy between ability and achievement. Similarly, consistent with its deficits in processing speed, the 2e-LD group earned equivalent or lower scores than the average-ability group in all clusters that included a speeded component (Reading Fluency, Math Calculation Skills, Written Expression, and Academic Fluency).

Nonetheless, the 2e-LD group earned significantly higher mean scores than the average-ability group for all achievement clusters without a fluency component. Additional analyses also illuminated 2e-LD academic strengths that were obscured by the Average-range 2e-LD group means and that

Table 5. Percentage of Each Group With Scores Below and Above Certain Thresholds for Cognitive and Achievement Variables.

	Below average (<90)			Above average (>110)			120+			130+		
Score	Gifted	2e-LD	Avg-ab	Gifted	2e-LD	Avg-ab	Gifted	2e-LD	Avg-ab	Gifted	2e-LD	Avg-ab
Cognitive ability												
GIA	0.0	5.1	11.9	85.4	25.3	10.1	53.9	6.1	0.0	12.3	1.0	0.0
Gf-Gc	0.0	1.0	11.0	90.0	77.8	9.0	55.3	33.3	0.0	13.5	5.1	0.0
Gf	1.3	13.1	14.9	75.7	50.5	13.3	50.8	41.4	0.0	12.2	7.1	0.0
Gc	1.5	4.0	16.7	71.0	70.7	13.3	49.2	62.6	0.0	16.4	17.2	0.0
Gs	1.0	48.5	20.4	50.2	17.2	20.8	26.5	8.1	7.0	7.5	1.0	1.1
Gwm	1.2	26.3	18.8	64.6	32.3	20.7	36.5	13.1	5.9	11.1	2.0	0.7
Ga	1.3	26.3	22.5	59.4	33.3	19.7	31.6	15.2	5.6	11.0	6.1	0.9
Glr	1.8	27.3	20.0	54.2	28.3	21.1	28.4	16.2	6.6	9.8	3.0	1.5
Gv	5.7	20.2	20.6	48.6	22.2	23.8	26.5	5.1	7.9	11.0	1.0	1.8
Achievement area												
BRS	1.6	10.1	15.1	60.3	35.4	19.6	32.5	16.2	5.7	13.5	6.1	1.3
RC	1.6	7.1	14.8	64.9	32.3	21.2	34.7	10.1	5.7	12.2	2.0	1.2
RF	2.8	13.3	15.9	62.8	21.4	20.1	34.7	7.1	6.1	11.8	0.0	1.1
MCS	2.5	15.2	14.9	61.6	25.3	20.6	34.3	7.1	5.2	13.8	3.0	1.0
MPS	0.7	8.1	14.3	69.3	52.5	18.1	38.2	14.1	4.5	12.2	5.1	0.5
BWS	1.6	11.2	15.5	63.9	31.6	20.5	34.2	13.3	5.5	12.4	5.1	1.0
WE	3.7	19.2	14.3	57.7	14.1	23.2	32.2	6.1	7.8	13.4	2.0	2.0
AS	0.7	8.1	12.8	66.6	34.3	18.1	36.6	10.1	4.4	13.6	3.0	0.8
AA	0.7	3.0	11.7	75.1	37.4	20.3	43.8	12.1	5.0	16.5	2.0	1.1
AF	2.4	16.3	15.4	58.7	18.4	20.1	32.3	6.1	5.5	11.5	0.0	1.1

Note. 2e-LD = gifted with a learning disability; Avg-ab = average-ability; GIA = General Intellectual Ability; Gf-Gc = fluid reasoning/comprehension-knowledge composite; Gf = fluid reasoning; Gc = comprehension-knowledge; Gs = processing speed; Gwm = short-term working memory; Ga = auditory processing; Gv = visual–spatial processing; Glr = long-term retrieval; BRS = Basic Reading Skills; RC = Reading Comprehension; RF = Reading Fluency; MCS = Math Calculation Skills; MPS = Math Problem Solving; BWS = Basic Writing Skills; WE = Written Expression; AS = Academic Skills; AA = Academic Applications; AF = Academic Fluency.

were not present in the average-ability group. For example, almost half (41.4%) of the 2e-LD group earned at least one achievement score of 120+, compared with 23.7% of the average-ability group; 2e-LD rates of above-average, 120+, and 130+ scores were highest for Basic Reading, Math Problem Solving, and Basic Writing.

According to Levene's test, the three groups had statistically significantly different variability for all academic cluster scores except Math Problem Solving. Unexpectedly, the standard deviations were often higher or equivalent for the gifted group compared with the 2e-LD group, but other analyses revealed 2e-LD heterogeneity in performance. For example, the 2e-LD group had higher rates of academic talent indicators than the average-ability group despite similar rates of academic deficits (Table 6).

Table 6. Prevalence of Academic Talent and Deficit Indicators for the Total Sample and Each Group.

	Total sample	Gifted	2e-LD	Avg-ab
Academic talent indicators				
Any cluster 130+	11.4	41.1	13.1	5.8
Any cluster 120+	29.9	78.2	41.4	23.7
Deficit indicators				
Any ach cluster <90	51.3	9.4	42.4	46.2
Processing score <90	53.1	5.1	100.0	54.8

Note. 2e-LD = gifted with a learning disability; Avg-ab = average-ability; Ach = achievement. A processing score <90 was one of the identification criteria for the 2e-LD group; therefore, all students in the 2e-LD group exhibit this indicator.

Discussion

This study is the first to identify a group of students as potentially 2e-LD using a standard set of identification criteria applied to a nationally representative sample. The main goal of this study was to provide empirical information about the cognitive and achievement patterns of students classified as potentially 2e-LD with the hope that such information can guide assessment, identification, and support of this population. A secondary goal of the study was to evaluate the validity of the specific identification criteria by comparing the associated identification rate and group characteristics with past research on students who are 2e-LD.

Cognitive Characteristics

The 2e-LD identification criteria used in this study guaranteed that students classified as potentially 2e-LD exhibited

Table 7. Descriptive Statistics for Absolute Score Discrepancies for Each Group.

	M			*Mdn*			*SD*		
Discrepancy	Gifted	2e-LD	Avg-ab	Gifted	2e-LD	Avg-ab	Gifted	2e-LD	Avg-ab
Ability tilt (Fluid reasoning vs. comprehension-knwl)	16.62	23.74	10.82	15.26	21.59	9.05	11.33	13.28	7.94
IQ score depression (GIA vs. fluid/comprehension-knwl)	6.86	11.38	5.46	5.96	11.61	4.47	5.20	6.13	4.34
Processing speed vs.									
Fluid/comprehension-knwl	14.19	23.02	11.66	12.51	22.70	9.99	9.97	13.36	8.75
Fluid reasoning	14.56	22.16	12.17	12.57	20.41	10.56	10.39	13.35	9.22
Comprehension-knwl	14.80	25.97	12.75	11.98	26.82	10.40	11.51	15.08	9.66
Working memory vs.									
Fluid/comprehension-knwl	11.67	16.58	10.17	9.85	13.74	8.40	8.59	12.22	7.92
Fluid reasoning	13.01	17.53	10.92	11.22	14.53	9.16	9.68	13.72	8.18
Comprehension-knwl	13.47	19.73	11.78	11.27	17.44	9.98	9.98	14.38	8.98

Note. 2e-LD = gifted with a learning disability; Avg-ab = average-ability; GIA = General Intellectual Ability; Comprehension-knwl = comprehension-knowledge (a measure of verbal abilities); Fluid/comprehension-knwl = fluid reasoning/comprehension-knowledge composite. All means are significantly different, 2e-LD > gifted > average-ability.
$ps < .003$.

strengths in verbal and/or reasoning abilities. Beyond these selection effects, the specific criteria identified a group of students with particularly strong verbal abilities; the 2e-LD group mean comprehension-knowledge score (117.21) was commensurate with that of the gifted group (117.41) and similar to the mean Verbal Index score from a quantitative synthesis of 2e-LD studies (118.6; Lovett & Sparks, 2011). Overall, however, results suggest that the gifted abilities of students who are 2e-LD are neither as strong nor as consistent as those in the gifted group even though the groups were identified with the same gifted criteria. An ability tilt between verbal ability and fluid reasoning was much larger among students identified as potentially 2e-LD (23.74 points) than in the comparison groups and favored verbal abilities. The mean 2e-LD fluid reasoning score was 110.14 and a full standard deviation lower than the mean PIQ score in the Lovett and Sparks (2011) research synthesis (125.9), perhaps because the PIQ measures visual as well as reasoning strengths and visual strengths are not strongly related to academic performance. Previous research has reported stronger verbal than nonverbal abilities among students who are 2e-LD (e.g., Assouline et al., 2010) as well as the opposite pattern (e.g., Nielsen, 2002); any pattern may be due in part to selection effects associated with specific identification criteria.

The 2e-LD identification criteria used in this study also guaranteed that students in the 2e-LD group had at least one processing deficit. Students could qualify with a deficit in processing speed, short-term working memory, auditory processing, or long-term memory and retrieval, but deficits in processing speed were most common and affected almost half of the 2e-LD group compared with approximately one quarter of the group for each other processing deficit.

Overall, 2e-LD cognitive scores were characterized by notable heterogeneity, as reported and discussed in past 2e-LD literature. In addition to higher levels of variance for most cognitive variables, students in the 2e-LD group exhibited higher rates of processing deficits than both other groups but also higher rates of processing strengths than the average-ability group in all processing abilities except processing speed. All of the cognitive discrepancy scores were largest in the 2e-LD group. The discrepancies between the GIA and verbal abilities (12.23) and between the GIA and fluid reasoning/comprehension-knowledge composite (11.38) were approximately twice as large in the 2e-LD group than the other groups and similar in magnitude to FSIQ/GAI discrepancies in previous research (Assouline et al., 2010).

Such large discrepancies can render summary cognitive scores uninterpretable, as is often the case for gifted students (NAGC, 2018); in this study, the cognitive weaknesses and discrepancies in the 2e-LD group appeared to depress performance on the measure of general intelligence, as described in the literature (Assouline et al., 2010; Silverman, 1989). Despite their strengths in verbal and fluid reasoning, the 2e-LD group earned a mean overall intelligence score in the Average range (104.98), likely due to Average-range mean scores in all other cognitive abilities, and only 6 students out of 99 in the 2e-LD group earned a GIA score of 120 or higher. The 2e-LD mean GIA score is much lower than the mean FSIQ score of 122.8 reported in Lovett and Sparks's (2011) synthesis, perhaps because students in this study were required to earn at least one processing score below 90 to qualify as 2e-LD. These large 2e-LD discrepancies support recent recommendations from NAGC that practitioners consider multiple index scores on the WISC-V to determine giftedness instead of requiring overall high performance on the FSIQ or across multiple cognitive domains (NAGC, 2018).

Academic Characteristics

Researchers have rarely examined 2e-LD academic performance in detail, and the results of this study provide information about common strengths and weaknesses among students identified as potentially 2e-LD as well as measures of intraindividual and interindividual heterogeneity in performance. The 2e-LD group in this study earned mean scores in the Average range for all academic areas studied. These results are relatively consistent with the results of the 2e-LD synthesis (Lovett & Sparks, 2011) in which students' weighted mean academic scores were in the Average range for reading (95.8) and writing (93.0) and in the High Average range for math (111.1). The lower mean math score in this study may be more representative of gifted students with a diverse range of LDs, including those specific to math. Contrary to expectations, the 2e-LD group did not show markedly stronger performance on applied versus basic tasks. The two areas with strongest 2e-LD performance were Basic Reading Skills (a basic skill) and Math Problem Solving (an applied domain; see Table 5). As in past research, students with a math disability may have very strong decoding skills, and individuals with a reading disability may excel at math problem solving, particularly because the WJ IV is administered verbally and requires no reading (Bell et al., 2015). Overall, results highlight considerable variability in 2e-LD academic performance across students and across subjects. Only a small proportion (7.1%-19.2%) of the 2e-LD group performed below average for each area of achievement, and similar proportions (6.2%-16.2%) earned a score of 120+ in each area.

Results were also consistent with compensation and masking. The 2e-LD group earned slightly higher scores than the average-ability group in all areas without a fluency component despite their cognitive deficits. More students in the 2e-LD group performed poorly on fluency-related academic tasks compared with the average-ability group, but more students in the 2e-LD group also excelled in other academic areas. These results suggest that students who are 2e-LD can compensate for their weak processing skills on some academic tasks, particularly those that do not require speed. The complementary result of compensation is a masking effect in which cognitive deficits mask students' gifts when they complete academic work, and this pattern was also present. For example, verbal abilities relate to performance in all the areas of achievement studied here, so the gifted and 2e-LD groups might be expected to perform similarly well on some academic tasks given their comparable scores for comprehension-knowledge (Flanagan et al., 2013; McGrew & Wendling, 2010). The 2e-LD group performed worse than the gifted group in all academic areas, however, often by a standard deviation or more on the mean group score. Additionally, the low rate of academic scores of 130+ among students who are 2e-LD suggests their disabilities may often preclude exceptional achievement. Research has documented similar masking patterns in verbally gifted youth with dyslexia, whose reading and writing scores are often in the Average range despite Superior scores on verbal reasoning tasks (Berninger & Abbott, 2013; van Viersen et al., 2014).

Table 8. Cognitive and Achievement Scores for Several Students Identified as Potentially 2e-LD.

	Student		
Score	A	B	C
Cognitive ability			
GIA	105	117	101
Gf-Gc composite	130	117	119
Fluid reasoning	117	107	125
Comprehension-knowledge	133	121	107
Processing speed	88	111	88
Short-term working memory	97	131	105
Auditory processing	114	86	102
Long-term retrieval	97	104	121
Visual–spatial processing	109	77	117
Achievement area			
Basic Reading Skills	131	94	88
Reading Comprehension	125	86	93
Reading Fluency	108	110	93
Math Calculation Skills	107	119	92
Math Problem Solving	131	111	113
Basic Writing Skills	132	114	87
Written Expression	102	98	103
Academic Skills	131	107	86
Academic Applications	120	100	107
Academic Fluency	107	119	96

Note. 2e-LD = gifted with a learning disability; GIA = General Intellectual Ability; Gf-Gc composite = fluid reasoning/comprehension-knowledge composite.

Interindividual Heterogeneity

Because results documented considerable heterogeneity among the 2e-LD group, it is critical to emphasize that the other cognitive and achievement trends identified here characterize many 2e-LD students but do not apply to every member of the group. This qualification is true of the 2e-LD population as a whole and particularly relevant to the potentially 2e-LD group identified here because the methodology and small sample size made it difficult to separate the 2e-LD group into subgroups based on type of learning disability or specific strengths and weaknesses. Furthermore, as aforementioned, individual strengths and weaknesses can vary even among 2e-LD students with the same category of LD. To put the overall results in context and to provide a brief illustration of the variability in performance within individual profiles and across students, Table 8 displays cognitive and achievement scores for three students identified as potentially 2e-LD in this study.

Student A reflects some of the trends noted in this article, including an ability tilt of 16 points favoring verbal versus reasoning abilities, a discrepancy of 1.67 standard deviations

(25 points) between the GIA and fluid reasoning/comprehension-knowledge composite, and below-average processing speed. In line with this cognitive profile, Student A excelled in most academic domains (scores 125-132) and had relatively circumscribed academic weaknesses as indicated by Average-range scores for all speeded achievement tasks (102-108). Student A may benefit from advanced or accelerated programming in multiple academic domains and a de-emphasis of speeded tasks.

Student B also exhibited an ability tilt in favor of verbal reasoning (of 14 points or 0.93 standard deviations), but this student did not display depression of a full-scale intelligence score or weaknesses in processing speed, short-term working memory, and speeded academic tasks that are often considered hallmarks of students who are 2e-LD. Instead, Student B displayed a weakness in auditory processing, which may indicate a learning disability in reading or writing. Accordingly, Student B demonstrated relative weaknesses on decoding and reading comprehension tasks and may need additional support or accommodations for a reading disability despite apparent academic strengths in math and basic writing skills.

Finally, Student C demonstrated a weakness in processing speed and average or below-average performance in most academic areas, as was typical among this 2e-LD sample, but Student C also exhibited an ability tilt in favor of reasoning versus verbal abilities (by 18 points or 1.2 standard deviations) and a relative strength in Math Problem Solving, an area of achievement often linked to fluid reasoning abilities (e.g., Niileksela et al., 2016).

As the scores for these three students demonstrate, there is no single profile nor any guaranteed pattern of strengths and weaknesses that will accurately characterize all students who are 2e-LD or even all students who are 2e-LD with the same learning disability. Nonetheless, all three student profiles highlight the need for dual differentiation to support areas of academic weakness and provide appropriate challenge in areas of academic strength, although the scope and intensity of the challenge and support needs vary from student to student. Although this article identifies some cognitive and academic characteristics that are relatively common among individuals identified as 2e-LD, these characteristics are best understood as potential indicators of 2e-LD status, and an individual psychoeducational evaluation is still necessary to accurately identify giftedness or an LD and to determine appropriate academic services.

Identification Criteria Validity

A secondary goal of this study was to examine the validity of the 2e-LD identification criteria, which were based on suggestions from Maddocks (2018) and which required absolute strengths in verbal and/or reasoning abilities, an ability-achievement discrepancy ≥1.5 standard deviations, and a below-average score in at least one processing ability associated with achievement. The group of students identified as potentially 2e-LD was small (n = 99 out of 3,865), but the identification rates in the sample (2.6%) and among the potentially gifted sample (12.7%) appear appropriate given the hypothesized low incidence rate of 2e-LD status in the population. No agency collects prevalence rates for twice exceptionality, but the National Center for Learning Disabilities reports that 5% of students in the United States have an identified LD and that an additional 15% or more of students may have an unidentified learning or attention disability (Cortiella & Horowitz, 2014). Therefore, it seems likely that 5% to 20% of gifted students would have an LD. Similarly, the gifted criteria in this study identified 21.5% of the standardization sample as potentially gifted; if this rate is applied to the estimated 5% to 20% of students in the United States with an LD, estimated identification rates for concurrent gifted and LD status in the population as a whole range between 1.1 and 4.3%. Furthermore, the criteria did not overidentify or underidentify students based on sex, race, Hispanic ethnicity, or parent education levels.

As described above, mean cognitive and achievement levels were relatively consistent with past research with 2e-LD samples. Discrepancy magnitudes were also similar to those reported in past studies. The most notable difference between the results of this study and past research was the lower GIA score in the Average range. Overall, these results suggest that the identification criteria in this study achieved reasonable validity and, if anything, may have been more stringent than some criteria used in past 2e-LD research by requiring a cognitive weakness.

Implications for Practice

This study offers a unique examination of 2e-LD cognitive and achievement characteristics and complements research with convenience or community samples of students who are 2e-LD. The criteria used to identify any exceptional group create some predictable group characteristics, and in this study I tried to illuminate some characteristics of the identified group that were not guaranteed by the identification criteria. Students classified as potentially 2e-LD demonstrated significant weaknesses in some areas of processing and achievement, as guaranteed by the criteria, but they also demonstrated processing and academic strengths that exceeded those of average-ability peers. Therefore, it is critical that educators and psychologists explore and understand both strengths and weaknesses of students who are 2e-LD. Masking and compensation may obscure students' concurrent giftedness and disabilities; therefore, education for teachers and parents could emphasize the fact that large discrepancies between abilities or heterogeneous achievement patterns may indicate 2e-LD status and thereby warrant further assessment and support. Additionally, it may be helpful to emphasize that some students who are 2e-LD have weaknesses that are relative instead of absolute. These students may perform on grade level but still have an underlying LD. Thorough psychological evaluations can inform dually differentiated educational plans that provide appropriate challenges in areas of strength alongside support or accommodations for areas of weakness.

As a group, students classified as potentially 2e-LD exhibited slower processing speed than average-ability peers and performed particularly poorly on academic tasks that measured fluency. Therefore, it may be appropriate to de-emphasize speeded academic tasks in identification processes and curriculum for students who are 2e-LD, although it is also important to note that processing speed is a strength for some students who are 2e-LD. Results also supported the use of identification measures that focus specifically on verbal and reasoning abilities instead of summary intelligence scores, in line with recommendations by NAGC (2018) and other experts (e.g., Assouline et al., 2010).

Limitations and Future Research

The nationally representative data set and standard identification criteria used in this study improved the generalizability of the findings, but several notable limitations of this methodology may inform future research. The students classified as 2e-LD in this sample were analyzed as a single group even though they had different cognitive strengths and LDs in different areas, as illustrated by the student scores in Table 8. For example, the 2e-LD group identified in this study showed particularly strong verbal abilities and relatively weaker fluid reasoning abilities as a group, which may limit the generalizability of some of these findings to 2e-LD students with verbal versus nonverbal strengths. The interindividual variability in 2e-LD performance highlights the need for continued research that examines performance patterns for individual 2e-LD students and for specific subgroups with similar strengths and disabilities (e.g., verbally gifted with dyslexia). In particular, more research is needed on students who are 2e-LD who have nonverbal strengths or LDs in math or writing.

Furthermore, best practices to identify giftedness and LDs require multiple indicators and the criteria in this study are not considered valid for "true" identification of 2e-LD status, which requires more thorough assessment data and a psychoeducational evaluation by a trained professional. Therefore, another limitation is that there is no way to determine whether the students identified as potentially gifted and 2e-LD in this study are truly gifted or 2e-LD. It would be useful to compare the results found here with cognitive and achievement characteristics of students identified as 2e-LD using similar criteria but within the context of thorough psychoeducational evaluations.

A third limitation is that most research with gifted populations has been conducted with the Wechsler scales (e.g., Lovett & Sparks, 2011; NAGC, 2018) and I used the WJ IV for this study. The WJ IV and the WISC-V measure similar abilities and are both consistent with CHC theory, but future research should examine whether the results found here are replicated with the WISC-V. Some experts on giftedness and twice exceptionality have expressed concern about changes to the WISC-V such as the increased use of timed tests, shorter discontinue criteria, and fewer supplemental tests (NAGC, 2018). Therefore, future gifted research with a range of cognitive test batteries, including the WJ IV or others, may be beneficial to offer alternatives to the WISC-V. Additionally, it is unknown whether students who are 2e-LD perform consistently across different measures of academic achievement. Therefore, it may be helpful for future research to examine whether different measures of academic performance (e.g., the WJ IV, the WIAT-III, curriculum-based measures, and others) identify similar groups of students as 2e-LD.

Despite these limitations, the criteria used in this study demonstrated adequate validity for screening 2e-LD status or identifying potentially 2e-LD students in large data sets for research purposes. Future research might apply similar criteria to school, clinical, or national data sets to identify students as potentially 2e-LD and examine other characteristics, processes, or outcomes (e.g., see Bell et al., 2015, for a similar approach with curriculum-based instruction data). For example, researchers might examine whether ability tilts predict academic performance, subject preferences, and career decisions of individuals who are 2e-LD as they do among gifted individuals. Future research with students who are 2e-LD could also explore whether specific patterns of strengths and weaknesses relate to emotional well-being, academic self-regulation, ability to benefit from specific supports, or other aspects of development and learning.

Author's Note

This article is based in part on the author's doctoral dissertation. Standardization data from the Woodcock-Johnson® IV (WJ IV®). Copyright © by Houghton Mifflin Harcourt. All rights reserved. Used with permission of the publisher. Danika L. S. Maddocks is now affiliated with the Washburn Center for Children, Minneapolis, MN, USA.

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