RUNNING HEAD: WJ-III Tests of Achievement

Using the WJ-III Tests of Achievement with the WISC-III and WAIS-III in the Determination of a Specific Learning Disability

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The current procedure most frequently used for diagnosing a specific learning disability (SLD) is based on the discrepancy model wherein a child must demonstrate a significant difference between her or his ability (as measured by an intelligence test) and achievement (as measured by an individually administered standardized assessment tool). Assumptions implicit in this definition are: (a) achievement and ability are highly correlated such that *expected achievement* is predicted by IQ; (b) the ability-achievement discrepancy denotes a disability whereas comparable scores signify functioning at or near capacity; and, (c) scores on a variety of intelligence and achievement tests are equivalent and stable across time (e.g., testing completed 3 months later with different IQ and achievement measures will yield comparable discrepancy results; Bocian, Beebe, MacMillan, & Gresham, 1999; Fletcher et al., 1998).

Ability-Achievement Discrepancy Calculations

The ability-achievement discrepancy model has its roots in the original definition utilized in Public Law 94-142 (United States Office of Education, 1977) and continues via reauthorization in the Individuals with Disabilities Education Act (IDEA) of 1990. There is, however, a lack of consensus on how such a discrepancy should be calculated. Three methods of calculation are frequently employed: (a) use of an IQ score to predict *expected grade level* of achievement, (b) the simple difference score comparison of IQ and achievement *standard scores*, and (c) regression calculations that adjust the *standard score* comparisons by the observed correlation between the IQ and achievement measures (Evans, 1990). The use of real discrepancy norms, which is only possible when the ability and achievement tests are co-normed *and* the regression-adjusted discrepancy scores obtained in the standardization sample are converted to normative scores, represents a fourth method (McGrew, 1994). This fourth method is represented by the ability-achievement discrepancy procedures that are available when the Woodcock-Johnson Tests of Cognitive Ability and Tests of Achievement (WJ III COG, WJ III ACH; Woodcock, McGrew, & Mather, 2001) are used together.

There are inherent difficulties with the first two discrepancy methods. First, any formula that uses *grade expectancy* is inherently flawed because grade formulas are uneven metrics that have considerable variability across ages (Reynolds, 1984). Second, the simple comparison of standard scores between two tests is problematic because (a) the correlation between achievement and IQ is far from perfect, a condition that necessitates a correction for regression to the mean, and (b) mean IQ scores increase at a rate of approximately 3 points per decade, an occurrence known as the Flynn effect (Flynn, 1984). Illustrations of these issues follow.

First, a 1-point drop or increase in IQ does not result in a corresponding 1-point drop or increase in achievement. For this to occur, the correlation between ability and achievement measures must be perfect 1.0. Such is never the case. The imperfect ability-achievement correlation results in *regression to the mean*, the phenomenon wherein a high score on one test will, on average, be accompanied by a lower score on the second test, and vice versa (Reynolds, 1984). The lack of a 1-1 ability-achievement score correspondence results in the simple difference method over-identifying high ability individuals and under-identifying low-ability individuals as having a significant discrepancy. Finally, because achievement measures do not evidence the Flynn effect so apparent in cognitive tests (Gaskill & Brantley, 1996; Truscott & Phelps, 2002), a significant discrepancy is more likely to occur if an outdated IQ test is utilized.

To avoid the further confoundment of the Flynn effect, examiners should utilize ability and achievement tests that are normed simultaneously or in close time proximity.

A less statistically flawed approach for determining an ability-achievement discrepancy is to use a regression formula that corrects for regression to the mean (Evans, 1993). The equation to correct for regression to the mean and compute the predicted achievement score is calculated by the following formula (Reynolds, 1990):

$$Y = r_{xy} (X - 100) + 100$$

where Y = predicted achievement score

r_{xy} = correlation of the administered ability and achievement measures

X = score obtained on the ability measure

The actual discrepancy is then determined by comparing the *predicted* achievement score to the *actual* achievement score. If one uses a point-difference criterion (e.g., 15-point difference) for the determination of learning disability (LD) eligibility, use of the *standard error of estimate (SEE), not the actual standard deviation (SD)*, is then required. That is, the SEE is the standard deviation of the actual achievement test around the predicted achievement score. The higher the correlation between the ability and achievement measures, the lower the SEE. It is the SEE, not the actual SD, that is used to determine if the discrepancy is significant (Pedhazur, 1997). This last point is critical to note as a +1 SEE value typically ranges from 10-12 standard score points, and *not* 15 standard score points, a common misunderstanding (McGrew, Werder, & Woodcock, 1991; McGrew & Woodcock, 2001), When using the regression model, the sample upon which the observed correlations were calculated should be sizeable and representative of the population at large. Finally, it would be optimal if correlations were obtained at different developmental (age or grade) levels given that the relations between ability and achievement vary developmentally (McGrew, 1994).

WJ III Ability-Achievement Discrepancy Options

The highest level of technical adequacy for ability-achievement discrepancy scores is present when: (a) ability and achievement tests are normed on the same nationally representative sample; (b) the correlations used to adjust for regression effects vary as a function of ability and developmental level (age or grade) and curriculum area (e.g., reading, math); and, (c) the actual regression-adjusted ability-achievement discrepancy scores are calculated in the norm sample and then used to construct actual discrepancy norms. Because the WJ III ability-achievement discrepancy procedure meets these conditions for optimal technical adequacy, the resultant WJ III norm-based ability-achievement discrepancies are the best possible estimates of discrepancies when using the WJ III COG and ACH batteries.

However, due either to tradition, preference, and/or guidelines, assessment professionals may chose not to use the WJ III COG as their measure of ability. Probably the most frequent practice is the use of one of the Wechsler batteries as the measure of cognitive ability together with the WJ III ACH. In this situation, given that the ability and achievement measures are not longer co-normed, which results in the inability to calculate developmental- and curriculum-sensitive regression-adjusted discrepancy scores, it is necessary to then use the regression calculation procedures outlined above.

Using a sample (N = 252) of non-referred individuals ages 6-16 years, a regression table (Schrank, Becker, & Decker, 2001) was developed that outlines the expected achievement scores on various tests and cluster scores of the WJ III ACH battery given the Wechsler Intelligence Scale for Children-Third Edition Full Scale IQ score (WISC-III; Wechsler, 1991). The calculations in this table correct for regression to the mean and are accompanied by a worksheet that uses the SEE to determine significance. These materials are provided in Appendix A of this book (see pp. ?-?). Table 1 provides the obtained and corrected correlations between the WISC-III and WJ-III ACH clusters and the SEE for the sample. Table 2 contains similar data for the Wechsler Adult Intelligence Scale –Third Edition (WAIS-III; Wechsler, 1994) and the W-J III ACH clusters (N = 89). Caution should be exercised when using the WAIS-III/WJ-III data for ability-achievement discrepancy calculations because (a) the sample size is somewhat small, and (b) the WAIS-III Full Scale IQ mean was 113.00, suggesting that the sample may not be representative of the population at large. Furthermore, caution must also be exercised given that the calculations underlying the tables use a single correlation in each curriculum area for all possible age or grade levels. Therefore, the resultant expected scores do not account for any developmental changes in the correlations between the respective Wechsler ability measure and WJ III ACH measures. If developmental considerations in ability-achievement discrepancy calculations are deemed important, then users are strongly encouraged to use the WJ III COG together with the WJ III ACH and to then interpret the discrepancy scores provided by the WJ III scoring software.

Alternatives to the Ability-Achievement Discrepancy Model

Even when the more statistically sound ability-achievement regression model is employed, considerable debate remains regarding the entire appropriateness of the discrepancy model. Because numerous studies utilizing traditional IQ tests (e.g., WISC-III; Stanford-Binet Intelligence Scale – 4th Ed. [SB:IV; Thorndike, Hagen, & Sattler, 1986]) have failed to find a distinct cognitive profile for children classified as learning disabled (LD), many researchers have advocated that an assessment of ability (i.e., administration of an IQ test) is irrelevant (Fletcher et al., 1994, 1998; Gresham & Witt, 1997; Reschly & Ysseldyke, 1995;Vellutino, Scanlon, & Lyon, 2000). Other researchers have recommended either constructing new cognitive measures that are more sensitive to specific processing domains (Daniel, 1997; Wilson & Reschly, 1996) or developing new theoretical approaches for interpreting existing measures (Flanagan, McGrew, & Ortiz, 2000; McGrew & Flanagan, 1998).

Flanagan (2000) has advocated that IQ tests must be theory-based in order for the relationship between unique cognitive processes (e.g., fluid reasoning, short-term memory) and specific academic skills (e.g., reading comprehension) to be clearly understood and translated into related treatment procedures. Although “assessment for intervention” has long been a tenet of school psychology training, such has seldom been translated into practice (Wilson & Reschly, 1996). When a test is atheoretical in nature, it greatly constrains and limits any inferences that can be drawn from subtest, factor, or composite score analysis, especially as to how scores are related to processing competencies or treatment planning (Flanagan et al., 2000; Keith & Witta, 1997).

Alternative definitions of LD explored in the literature include (a) low achievement in and of itself (e.g., scoring at, or below, one standard deviation on an achievement measure) and, (b) failure to respond to treatment (Hoskyn & Swanson, 2000; Iversen & Tummer, 1993; Stanovich & Stanovich, 1997; Vellutino et al., 2000; Wasik & Slavin, 1993). Depending on the definition of “low achievement” (e.g., one standard deviation below the normative mean), the first alternative would mean that approximately 16% (the percentile equivalent at one standard deviation below the mean) of the population would be classified as LD, a figure that would bankrupt federal and state funding sources. Lowering the cut-score (e.g., only the bottom 8 % of the population) would be one alternative to this option. The second definition assumes that "… children who are difficult to remediate may be accurately classified as disabled readers, whereas many, or most, children who are readily remediated may not be accurately classified as disabled learners… (Vellutino et al., 2000, p. 228). The second definition further assumes that school districts provide quality, individualized instruction that could accurately separate children whose poor reading is a function of lack of opportunity from those who cannot perform in spite of receiving appropriate tutoring (Pressley, 1998).

A third alternative is the identification of processes that are specific to children with reading disorders (i.e., skills that reliably *differentiate* children with reading disorders from children who are low achievers). It is evident that global IQ scores, in isolation, predict neither reading success nor response to treatment for children experiencing delays in reading acquisition (Siegel, 1992; Vellutino et al., 2000). Specific cognitive processes that do, however, provide notable assistance in identification of such children include language-based competencies such as phonemic awareness (knowledge of letter/sound relationships), rapid automatized naming of letters, symbols, and familiar words, and the decoding of more difficult words and pseudowords (Fletcher et al., 1994, 1998: Hoskyn & Swanson, 2000; Lyon & Moats, 1997; Stanovich & Siegel, 1994; Stanovich & Stanovich, 1997).

The primary impetus for evaluating relevant processing deficits specific to reading disorders comes from the Phonological-Core-Difference Model advocated by Stanovich and Siegel (e.g., Stanovich, 1988; Stanovich & Siegel, 1994). The assumptions of this model are::

(a) specialized processes (such as phonological competencies) are not closely related to global functioning (such as composite IQ) yet underlie reading failure; (b) both slow learners and children with reading disorders share a common phonological core deficit that is the source of their reading problems; and, (c) slow learners (comparable IQ/achievement scores) exhibit a flat cognitive profile (e.g., below average visual-spatial, verbal, and nonverbal problem-solving skills) and multiple academic skill deficits (all academic areas are deflated) whereas children with reading disorders (average IQ but below average reading) perform much better on nonverbal cognitive measures and display far more variability in their academic skill competencies (e.g., above average performance in math but below average functioning in reading comprehension). A recent meta-analysis confirmed these findings and indicated that verbal IQ was a strong mediating variable (Hoskyn & Swanson, 2000). The researchers found that the higher the verbal IQ, the more likely there were cognitive processing differences between the two groups. That is, children who were slow learners exhibited a flat cognitive processing profile and lower verbal IQ whereas children with reading disabilities displayed marked variability in cognitive processing profiles and higher verbal IQs.

Until federal and state requirements for a significant discrepancy in determining a specific learning disability are altered, many professionals must continue the existing procedures, however flawed. It is advocated, therefore, that practitioners (a) determine the ability-achievement discrepancy via procedures that calculate standard score differences with correction for regression to the mean (i.e., use of regression tables such as those provided in Appendix A or actual discrepancy norms); (b) administer ability and achievement measures that are normed simultaneously or in close time proximity; (c) utilize ability tests that are theory-based, and (d) assess processing skills that are related specifically to the disability in question (e.g., phonological awareness in the evaluation of a reading disorder). It should be noted that when assessing processing skills for the determination of a learning disability, if the processing skills are both deficient and part of a global ability cluster, then the ability-achievement cluster may not emerge as significant, a finding which, in and of itself, does not negate a diagnosis of LD. (Refer to Chapter ?? for a discussion of these issues.) These recommendations are illustrated in the following case study.

CASE STUDY

Approximately 80% of children classified as LD are evidencing reading impairment (Meyer, 2000). As mentioned previously, numerous research groups (e.g., Bowman Gray School of Medicine, Florida State University, John Hopkins, University of Colorado, University of Houston, University of Miami, Yale) funded by the National Institute of Child Health and Human Development have concluded that robust predictors of reading comprehension difficulties include deficits in (a) phonological awareness (knowledge of sound/letter relationships), (b) rapid automatized naming of letters and highly familiar simple words, and (c) decoding or "sounding out" more difficult words and pseudowords (Fletcher et al., 1998; Hoskyn & Swanson, 2000; Lyon & Moats, 1997; Stanovich & Siegel, 1994; Stanovich & Stanovich, 1997). For older students, the best prognostic indicator for *continued* reading problems is the inability to rapidly recognize and name words (i.e., sight word vocabulary; Badian, 1999; Meyer, Wood, Hart, & Felton, 1998). Given these data, analyses of phoneme competencies (i.e., knowledge of sound-symbol correspondence, decoding of words and pseudowords, sound blending), and basic reading skills (letter-word identification, rapid reading of simple words and sentences, sight word vocabulary), are appropriate and should be completed *in addition to* the customary assessment for the determination of an ability-achievement discrepancy.

Background Information

Zachary P. (a pseudonym), a 7-year old male, was referred for psychological testing at the end of the first grade. School records indicated that at the end of his kindergarten year, Zachary's teacher reported that he had gained few reading readiness skills and recommended retention. Because he was one of the older children in his class and was large for his age, both the school and his parents decided to promote him to the first grade. He was, however, targeted to receive remedial reading services throughout the first grade. These services consisted of small group (3-4 students) instruction for three times a week.

In spite of the remedial reading services, Zachary continued to make inadequate progress in reading and at the end of his first grade, both the remedial reading and regular classroom teachers referred him to the Committee on Special Education (CSE) for consideration of LD services. Both teachers noted that Zachary could not decode new words, read simple sentences very slowly, and exhibited poor reading comprehension.

A developmental history completed by Mrs. P. indicated that Zachary was a full-term baby and weighed 8 pounds, 7 ounces at birth. His medical history was unremarkable except for numerous episodes of acute otitis media (middle ear infections) that lasted until he was approximately 5 years old. Medical treatment included amoxicillan (an antibiotic) and several sets of ventilating tubes.

Developmental milestones were within the normal range except for speech acquisition. At age 3, Zachary's vocabulary was so limited that his pediatrician requested an evaluation be completed at a speech and language clinic affiliated with the local university. At the time, Mrs.

P. estimated that Zachary's vocabulary was approximately 100 words, with most vocalizations being one word (e.g., wa-wa, go, no). He communicated primarily with gestures. Because the speech and language assessment results indicated significant delays in receptive and expressive language, Zachary was referred for, and received, speech therapy at the clinic until he entered kindergarten. These services were discontinued at that time when a re-evaluation by the school indicated he no longer qualified for services.

Assessment Results

Wechsler Intelligence Test for Children – 3rd Edition (WISC-III)

Verbal Subtest	*Standard Score*	*Performance Subtest*	*Standard Score*
Information	8	Picture Completion	11
Similarities	7	Coding	12
Arithmetic	10	Picture Arrangement	10
Vocabulary	11	Block Design	10
Comprehension	8	Object Assembly	11
Digit Span	9	Symbol Search	12

Factor Indices	*Standard Score*	*Percentile*
Verbal Comprehension	92	30
Perceptual Organization	104	61
Freedom from Distractibility	98	45
Processing Speed	112	79

IQ Indices	*Standard Score*	*Percentile*
Verbal IQ	93	32
Performance IQ	106	68
Full Scale IQ	99	47

Using the Cattell-Horn-Carroll (CHC) theoretical framework to interpret the WISC-III (refer to Flanagan et al., 2000 for a complete discussion), it appears that Zachary's crystallized abilities (*Gc*) are somewhat weak (i.e., Information, Similarities, Vocabulary, Comprehension). Given his medical history of recurrent otitis media and early language impairment, his continued difficulties in language-related processing are to be expected (for a review, refer to Phelps, 1998). In comparison, his visual processing (*Gv*; Block Design, Object Assembly) and processing speed (Gs; Coding, Symbol Search) are more normalized.

Applying the Phonological-Core-Difference Model discussed earlier (Stanovich, 1988; Stanovich & Siegel, 1994), Zachary would appear to have a classic reading disorder. That is, he performs better on nonverbal tasks and displays variability in his cognitive processing profile. Likewise, following the Core Model, Zachary's WISC-III Verbal IQ score would suggest that he could benefit from, and respond well to, individualized reading instruction (Hoskyn & Swanson, 2000).

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Test	*Standard Score*	*Percentile*
Letter-Word Identification	85	17
Reading Fluency	86	18
Passage Comprehension	89	23
Word Attack	83	13

Spelling of Sounds	78	7
Sound Awareness	76	6
Cluster Scores	*Standard Score*	*Percentile*
Broad Reading	84	15
Phoneme/Grapheme Knowledge	81	11

These results validate the presence of a reading disorder. Zachary has notable difficulty with phonological processing. His ability to decode/encode pseudowords is impaired (Word Attack, Spelling of Sounds). His sound-letter knowledge and auditory processing are very weak (Sound Awareness, Letter-Word Identification). As a result, he cannot rapidly recognize and read simple words (Reading Fluency). In spite of receiving remedial reading instruction for one academic year, his reading comprehension is notably below average (Passage Comprehension). These data demonstrate that the primary cause of Zachary's reading difficulties is a core phonological processing deficit.

Zachary's WISC-III Full Scale IQ (99) and WJ-III ACH Broad Reading cluster are applied to the WISC-III/WJ-III Ability-Achievement Discrepancy Calculation Worksheet provided with the regression table in Appendix A. Using the regression table, Zachary's expected achievement is a standard score of 99 (based on the IQ score of 99 with the correction for regression to the mean). The resulting standard score discrepancy between the *actual* achievement score and the *predicted* achievement score is 15 points. The discrepancy is 18 points when using the WJ-III Phoneme/Grapheme Knowledge cluster. Using the standard error of estimate provided in the calculation worksheet (SEE

10.47 for Broad Reading cluster), Zachary has a 1.43 standard deviation achievement-achievement discrepancy.

The testing substantiates that Zachary would likely benefit from daily individualized instruction in basic sound-letter correspondence, sound blending, and word attack. In addition, it is recommended that Zachary practice spelling words that have dissimilar spelling yet are phonetically similar (e.g., bee, sea, key) and words that have disparate spelling and meaning yet are phonologically identical (e.g., there, their, they're; too, to, two). Academic instruction reflecting empirically supported cognitive strategies and directed practice in phonetic decoding and drilling are essential (refer to Swanson, Carson, & Sachse-Lee, 1996 and the Mather & Wendling chapter in this book for recommended instructional procedures appropriate for LD students).

Conclusion

Most psychological assessments completed in school systems are intended to substantiate learning difficulties evidenced in the classroom. Special education services typically are mandated until an individually administered battery of tests verifies a significant discrepancy between ability and achievement. Selection of the IQ and achievement scales is an important decision for psychologists. The discrepancy is meaningless unless scores on a variety of intelligence and achievement tests are relatively equivalent and stable across time. In considering assessment options, professionals are well advised to select batteries that are current (i.e., normed within the last decade), have excellent standardization, reliability, and validity data, and were normed simultaneously or in close time proximity to one another. In addition, examiners should choose tests that are theoretically sound and sensitive to specific processing domains. Such data will greatly aid in the interpretation and translation of results into related intervention procedures.

The discrepancy model for determining a specific learning disability is fraught with debate. Nonetheless, a best practices model dictates that grade levels should not be utilized because of the inherent variability across age groupings. Likewise, the simple standard score difference procedure is an unsound practice because of regression to the mean. Therefore, when assessment professionals choose not to use the WJ III COG together with the WJ III ACH, but instead select a different measure of cognitive functioning to combine with the WJ III, utilization of a regression formula that corrects for regression to the mean and computes predicted achievement scores is the most statistically sound practice.

In addition to assessment for the determination of a significant ability-achievement discrepancy, evaluation of specific processing domains directly related to the disability is advocated. Although there is a paucity of data for math disorders, there is considerable empirically supported data regarding reading deficits. An evaluation of these critical competencies is essential for guiding subsequent intervention procedures.

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Table 1

Obtained and Corrected Correlations between the WJ-III Achievement Scores and the WISC-III Full Scale IQ Score (N = 252)

W-J III Cluster	WISC-III Full Scale IQ		Mean	S.D.	SEE
	Obtained	Corrected			
Broad Reading	.61	.72	105.24	12.95	10.47
Broad Math	.60	.70	106.72	13.44	10.77
Broad Written Lang.	.43	.57	104.85	12.12	12.35

*WISC-III Full Scale IQ Score Mean = 103.87, Standard Deviation = 12.90

Table 2

Obtained and Corrected Correlations between the WJ-III Achievement Scores and the WAIS-III Full Scale IQ Score (N = 89)

W-J III Cluster	WAIS-III Full Scale IQ		Mean	S.D.	SEE
	Obtained	Corrected			
Broad Reading	.53	.60	106.16	13.01	12.03
Broad Math	.62	.67	107.35	13.53	11.10
Broad Written Lang.	.56	.64	108.66	12.44	11.50

*WAIS-III Full Scale IQ Score Mean = 113.00, Standard Deviation = 14.58