

Are Both the TOWRE-2 and the WIAT-III Basic Reading Composite Needed to
Accurately Identify Characteristics of Dyslexia?

by

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ABSTRACT

This study is a continuation of a previous master's thesis. Morgan Griffith (2016) found that the TOWRE-2 gives a lower estimate of a student's ability to read and decode at the word level than the WIAT-III. Currently, at the Tennessee Center for the Study and Treatment of Dyslexia, the Word Reading and Pseudoword Decoding subtests of the Wechsler Individual Achievement Test, 3rd Edition (WIAT-III) are used in addition to the Test of Word Reading Efficiency, 2nd Edition (TOWRE-2). The purpose of the present study was to determine if the same diagnostic conclusion would be reached by relying on the TOWRE-2 without the use of the Word Reading Composite of the WIAT-III. My diagnostic conclusion matched the original on 86% of the cases. Results of the chi-square, $\chi(1) = 25.42, p < 0.05$, indicated that I agreed with the original diagnostic decision significantly more than I disagreed.

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CHAPTER I

Introduction

Overview

The purpose of the study was to determine if the WIAT-III BRC had not been used, would students who had previously been described as having characteristics of dyslexia still be described as having characteristics of dyslexia? According to the National Center for Learning Disabilities, 5% of students nationally have been identified as having a learning disability. Of all students who are served in special education, Specific Learning Disability is the largest category. Of all specific learning disabilities, dyslexia is the most common and well-recognized subtype (Cortiella & Horowitz, 2014).

Dyslexia should be assessed through testing in academic and cognitive areas (International Dyslexia Association, 2014; Texas Education Agency, 2014). The evaluation should assess word recognition, decoding, spelling, oral language skills, phonological processing, reading comprehension, fluency skills, and vocabulary knowledge. In addition to formal testing, evaluations should include a detailed background of the student including family history, prenatal and birth history, speech and language history, records of attendance, and history of interventions (International Dyslexia Association, 2014). This process is detailed and time consuming. At the Tennessee Center for the Study and Treatment of Dyslexia, each testing appointment is scheduled for five hours with one snack break and one lunch break included in that time. If fewer tests could be used to determine an accurate diagnosis, this could reduce the total

time of assessment and students might not become as fatigued and this would contribute to valid test results.

For decades, researchers have been looking for ways to shorten testing batteries and overall assessment time. Satz and Friel (1978) conducted a study that looked at the predictive validity of a brief screener for reading disabilities. The abbreviated screener was made up of eight of the 16 tests in the standard battery. Results indicated that students with severe reading disabilities were correctly identified in 90% of the cases. This supports the idea that reading disabilities can be identified with shorter testing batteries.

In her thesis research, Griffith (2016) compared the mean scores on the Test of Word Reading Efficiency, second edition (TOWRE-2) Total Word Reading Efficiency (TWRE) Composite and the Basic Reading Composite (BRC) of the Wechsler Individual Achievement Test, third edition (WIAT-III) for a group of students evaluated at the Tennessee Center for the Study and Treatment of Dyslexia who had characteristics of dyslexia and a group of students who did not have characteristics of dyslexia. Both the WIAT-III BRC and the TOWRE-2 measure accuracy of decoding real words and nonsense words. On the WIAT-III, students have as much time as they need to read as many words as they can, but on the TOWRE-2, students are only given 45 seconds. The WIAT-III BRC indicates accuracy of word reading and pseudoword decoding. There is a separate percentage score for fluency based on how many words the student reads in the first 30 seconds (Psychological Cooperation, 2009). On the TOWRE-2, the student is only given credit for words read correctly during the 45 seconds allowed and

pseudowords read correctly during the 45 seconds allowed. Therefore, the TOWRE-2 TWRE Composite score indicates how fluently (quickly and effortlessly) the student can read the words and pseudowords as well as how accurately (Torgesen, Wagner, & Rashotte, 2012).

Griffith (2016) found that the mean score for the TOWRE-2 was significantly lower than the mean score for the WIAT-III for students with characteristics of dyslexia. This indicates that when compared to the WIAT-III, the TOWRE-2 gives a lower estimate of a student's ability to read and decode at the word level. Therefore, using the TOWRE-2 scores without the WIAT-III BRC may be sufficient for determining whether or not a student has a deficit in accuracy and/or fluency at the word level. The purpose of the study was to determine if students who were previously classified as having characteristics of dyslexia would still be classified as having characteristics of dyslexia without consideration of the scores from the WIAT-III BRC.

Definition of Dyslexia

Many organizations have different definitions of dyslexia, but most definitions include the same main characteristics. The International Dyslexia Association (IDA) defines dyslexia as trouble with recognizing words accurately and/or fluently, trouble with spelling, and poor decoding skills. Dyslexia is neurologically based, and is typically caused by a phonological deficit that cannot be attributed to lack of adequate instruction, or limited cognitive abilities. This specific learning disability can negatively influence reading comprehension and growth of vocabulary (International Dyslexia Association, 2002).

Tunmer and Greaney (2010) described four key components of dyslexia. First, children with dyslexia will have persistent difficulty learning specific to literacy (e.g., spelling and word recognition). Second, this difficulty will present in an individual who is otherwise typically developing. Third, the individual will continue to have literacy struggles after being exposed to evidence-based instruction and intervention. Finally, this difficulty must be due to a deficit in phonological processing. Tunmer and Greaney acknowledge that the definition of dyslexia adopted by IDA states that dyslexia is *typically* due to a deficit in phonological processing, but they go on to explain that the most evidence for a causal explanation of dyslexia points to a deficit in phonological processing.

The first state to pass a dyslexia-specific law was Texas in 1995 (Eide, 2016). The Texas Education Agency includes the IDA definition of dyslexia in their Dyslexia Handbook (Texas Education Agency, 2014). The Texas Education Agency Dyslexia Handbook reports that characteristics of dyslexia can include difficulty with phonological awareness, phonemic awareness (blending, segmenting, and manipulating phonemes), phonological memory, rapid naming, letter naming, letter-sound association, word reading, decoding, spelling, and reading fluency. These difficulties can lead to trouble with reading comprehension, writing, and limited vocabulary knowledge.

The Individuals with Disabilities Education Improvement Act of 2004 includes the term dyslexia in the definition of a specific learning disability:

“a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in

the imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculation, including conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, *dyslexia*, and developmental aphasia.” (emphasis added) (Individuals with Disabilities Education Improvement Act Section 34 C.F.R. §300.8(c)(10), 2004).

The Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-V) includes dyslexia under the category of specific learning disorder (American Psychiatric Association, 2013). The DSM-5 describes characteristics of dyslexia including difficulty with accurate or fluent word recognition, poor spelling, and poor decoding.

An important component of most definitions of dyslexia is that it typically results from a deficit in one or more of the core phonological processing areas (International Dyslexia Association Handbook, 2014; Texas Education Agency 2014; Tunmer & Greaney, 2010). There are three main components that make up phonological processing: phonological awareness, phonological memory, and rapid automatic naming (Wagner & Torgesen, 1987).

Core Phonological Deficit

Dyslexia is typically due to one or more core phonological deficits (International Dyslexia Association Handbook, 2014). Students with dyslexia usually have trouble with at least one area of phonological processing (Siegel, 2006). It is necessary to understand the phonological component of a language before one is able to apply those concepts to written language. Therefore, research indicates that, with few exceptions, a deficit in phonological processing is the source of dyslexia (Tunmer & Greaney, 2010).

Phonological awareness. Phonological awareness is a cognitive ability expressed through several skills including blending and segmenting phonemes that is important in acquiring reading skills (Anthony & Francis, 2005). Phonemic awareness is included in phonological awareness. Phonemic awareness is one's ability to manipulate spoken phonemes (National Reading Panel, 2000). These skills are used to sound out words when reading. If a student struggles to sound out words because of a deficit in phonological awareness, he or she may have trouble reading quickly and accurately, so comprehension of the text would likely be negatively impacted as well (Ashby, Dix, Bontrager, Dey, & Archer, 2013).

Phonological memory and working memory. Phonological memory is the ability to store auditory information in one's short-term memory (Lowell, Felton, & Hook, 2014). In students with phonological memory deficits, it is common to see deficits in working memory. Working memory is defined as one's ability to store and manipulate information in short-term memory (Mather & Wendling, 2012). A deficit in phonological memory can negatively impact reading because a student can forget the sounds at the beginning of a word by the time he or she gets to the end of the word (Lowell, Felton, & Hook, 2014). Phonological short-term memory is correlated with reading outcomes and predicts students' ability to read nonwords (Shapiro, Carroll, & Solity, 2013).

Rapid automatic naming. Rapid automatic naming (RAN) is one's ability to retrieve phonologically coded information efficiently from long-term memory (Logan, Schatschneider, & Wagner, 2011). According to Norton and Wolf (2012), "RAN

measures act as a microcosm of the reading system, providing an index of one's abilities to integrate multiple neural processes." In a RAN task, the student names rows of letters, numbers, colors, or objects. In order to be successful on a RAN task, as well as in reading, one has to identify stimuli accurately and quickly (Arnell, Joanisse, Klein, Busseri, & Tannock, 2009). Wolf and Bowers (1999) hypothesized that RAN deficits impede fluency in identifying words, which lowers comprehension. RAN is correlated with reading outcomes and predicts students' ability to read nonwords (Shapiro, Carroll, & Soly, 2013).

Automaticity and word recognition. Automaticity of word reading is processing information fluently without directly thinking about it (Harris & Hodges, 1995). The ability to recognize words automatically contributes to reading fluency (Roembke, Hazeltine, Reed, & McMurray, 2018). When students are concentrating on decoding each word, it is more difficult for them to focus on the meaning of the text. Therefore, in order for students to comprehend what they are reading, it is important for them to read automatically (Cadime et al., 2017). Phonological awareness, phonological memory, working memory, and rapid automatic naming are all necessary skills to support automaticity. The WIAT-III record form states that the student has to say each word fluently to receive credit (Psychological Cooperation, 2009). Both the TOWRE-2 and WIAT-III BRC measure automaticity of word reading and pseudoword decoding.

Assessment of Dyslexia

A book by Nancy Mather, Barbara Wendling, and Alan Kaufman titled *Essentials of Psychological Assessment: Essentials of Dyslexia Assessment and Intervention* (2011)

recommends assessment of phonological awareness, orthographic awareness, and morphological awareness. Assessments of word reading, spelling, nonword reading, nonword spelling, reading fluency, and prosody should be administered. Some measures that could be used for dyslexia assessment include early literacy CBMs, and norm-referenced tests: Dynamic Indicator of Basic Early Literacy Skills (DIBELS), Test of Word Reading Efficiency (TOWRE), Test of Irregular Word Reading Efficiency (TIWRE), Woodcock Johnson Diagnostic Reading Battery (WDRB), Woodcock Reading Mastery Tests (WRMT), and Wechsler Individual Achievement Test (WIAT) (Mather, Wendling, & Kaufman, 2011).

Recommendations for how dyslexia should be assessed are similar across many organizations. The International Dyslexia Association (IDA) and Texas Education Agency promote the assessment of similar academic and cognitive areas. The International Dyslexia Association Handbook (2014) gives a suggestion for evaluating students. The evaluation procedures at the Tennessee Center for the Study and Treatment of Dyslexia closely align with the IDA recommendation in the areas assessed and in considering additional information such as education and family history. The evaluation should assess possible deficits in word recognition, decoding, spelling, oral language skills, phonological processing, and reading fluency skills. Reading comprehension and vocabulary knowledge should be assessed as secondary consequences. In addition to formal testing, evaluations should include a detailed background of the student including family history of reading and spelling difficulties, prenatal and birth history, history of

delay or difficulty acquiring speech and/or language skills, school attendance records, and information about interventions that the student has previously received.

The Dyslexia Handbook: Procedures and Related Disorders (2014) from the Texas Education Agency listed suggestions for what domains should be assessed in a dyslexia evaluation. The two main areas addressed are academic skills and cognitive processes. Also, there are suggestions for possible additional areas that could be evaluated. The suggested academic skills that should be assessed include letter knowledge, word reading, decoding, fluency, reading comprehension, and spelling. The suggested cognitive processing areas include rapid naming of symbols/objects and phonological/phonemic awareness. Additional areas that could be assessed include vocabulary, listening comprehension, written and verbal expression, handwriting, memory for letters/symbol sequences, verbal working memory, phonological memory, math calculation/reasoning, and processing speed.

During my time as a graduate assistant at the Tennessee Center for the Study and Treatment of Dyslexia, we used the following procedures for assessments. Before a child is assessed, families are required to send in a parent information form, teacher information form, report card, benchmark data (part of the universal screening process at school), progress monitoring data (if available), an IEP or 504 plan (if applicable), a family history survey, and an early development checklist. A typical assessment at the Tennessee Center for the Study and Treatment of Dyslexia, at the time that data used in the current study were gathered, included the Wechsler Individual Achievement Test, Third Edition (WIAT-III), Test of Word Reading Efficiency, Second Edition (TOWRE-

2), Developmental Spelling Analysis (DSA), Comprehensive Test of Phonological Processing, Second Edition (CTOPP-2), Decoding Skills Test (DST) for children 10 and older, Phonological Awareness Test, Second Edition (PAT-2) for children under 10, Dynamic Indication of Basic Early Literacy Skills Next (DIBELS*Next*) for first grade through sixth grade, a grade level fluency passage for seventh through twelfth grade, and Woodcock Johnson, Third Edition (WJ-III) writing. During the assessment, an interview is conducted with the parent or guardian. Overall, the assessment procedures followed by the Tennessee Center for the Study and Treatment of Dyslexia align with the recommendations from IDA.

In a study that explored reliability and validity of phonics measures, the TOWRE was chosen as an assessment tool instead of the WIAT-II (Doty, Hixson, Decker, Reynolds, & Drevon, 2015). Griffith (2016) compared scores of students with and without characteristics of dyslexia on the WIAT-III and TOWRE-2.

Summary of Findings from Griffith (2016)

The previous study utilized existing TOWRE-2 and WIAT-III scores that were collected between September 2013 and May 2016 from files at the Tennessee Center for the Study and Treatment of Dyslexia. The study included data from 53 boys and 47 girls who were between 6 and 17 years old at the time the data was collected. Half of the participants had characteristics of dyslexia. The purpose of Griffith's study was to consider whether or not the TOWRE-2 TWRE Composite score would provide enough information to identify if a student had characteristics of dyslexia without the information from the WIAT-III BRC. Both of these instruments assess accuracy and automaticity of

word reading. The data gathered included WIAT-III BRC score, TOWRE-2 TWRE Composite score, gender, age, and whether or not the student had been identified as having characteristics of dyslexia. Erin Alexander, Assistant Director for Clinical Services, and two graduate assistants at the center gathered these data. A third graduate assistant checked the data for accuracy for every fifth student. The graduate assistant looked in the students' files for the scores on the WIAT-III BRC and the TOWRE-2 TWRE Composite and checked to see if the scores were written down accurately. Interrater reliability was 90%.

Griffith compared the mean scores on the TOWRE-2 and the BRC of the WIAT-III from a group of students who had characteristics of dyslexia and a group of students who did not have characteristics of dyslexia. Griffith (2016) found that the mean score on the TOWRE-2 was significantly different for students with characteristics of dyslexia ($M = 74.04$, $SD = 9.48$) and students without characteristics of dyslexia ($M = 91.22$, $SD = 10.25$), $t(49) = -4.23$, $p < .01$. Similarly, results indicated that the mean score for the WIAT-III BRC was significantly different for students with characteristics of dyslexia ($M = 79.76$, $SD = 8.35$) and students without characteristics of dyslexia ($M = 94.64$, $SD = 8.73$), $t(98) = -8.71$, $p < .01$. These results show that both the TOWRE-2 and WIAT-III BRC can discriminate between students with characteristics of dyslexia and students without characteristics of dyslexia.

The TOWRE-2 mean score was significantly lower ($M = 74.04$, $SD = 9.48$) than the WIAT-III BRC ($M = 79.76$, $SD = 8.35$) for students with characteristics of dyslexia, $t(49) = -4.23$, $p < .01$. The TOWRE-2 mean score was significantly lower ($M = 91.22$,

$SD = 10.25$) than the WIAT-III BRC ($M = 94.64$, $SD = 8.73$) for students without characteristics of dyslexia, $t(49) = -2.88$, $p < .01$. These results indicated that the TOWRE-2 gives a lower estimate of a student's ability to read and decode at the word level. Therefore, using the TOWRE-2 scores without the WIAT-III BRC may be sufficient for determining whether or not a student has characteristics of dyslexia.

Study Purpose

This study is a continuation of a previous master's thesis study completed by Morgan Griffith in 2016. Currently, at the Tennessee Center for the Study and Treatment of Dyslexia, the Word Reading and Pseudoword Decoding subtests of the Wechsler Individual Achievement Test, 3rd Edition (WIAT-III) are being used in addition to the Sight Word Efficiency and Phonemic Decoding Efficiency subtests of the Test of Word Reading Efficiency, 2nd Edition (TOWRE-2). The purpose of the study was to determine if the same diagnostic conclusion would be reached without the use of the Word Reading and Pseudoword Decoding subtests of the WIAT-III. If only the TOWRE-2 was used, the total time of assessment would be reduced and the students might not become as fatigued and this could possibly increase validity of test results.

Study Hypothesis

Hypothesis 1: There will not be a significant difference between the diagnostic conclusions reached utilizing all available information and the diagnostic conclusions reached without the use of the WIAT-III Word Reading and Pseudoword Decoding subtests.

CHAPTER II

Method**Participants**

The data for this study were collected from existing files at the Tennessee Center for the Study and Treatment of Dyslexia and included the same files used in Griffith's thesis study (2016). Griffith's study included 50 students with characteristics of dyslexia and 50 without. For the current study, files of 50 students from the 100 files previously used were randomly selected with a number generating program. In order to keep the raters from knowing exactly how many students included were originally found to have characteristics of dyslexia, the files were randomly selected from all of the original files instead of by group. See Table 1 for participant demographics.

Table 1

Participant Demographics

| | <i>Variable</i> | <i>N</i> |
|-------------------|-----------------|----------|
| Gender | Male | 26 |
| | Female | 24 |
| Age Group (years) | 6-9 | 24 |
| | 10-13 | 22 |
| | 14-17 | 4 |
| *Dyslexic | Yes | 24 |
| | No | 26 |

N = 50

*Original Diagnostic Decision using both TOWRE-2 and WIAT-III

The data were obtained by the Center for the Study and Treatment of Dyslexia between September 2013 and May 2016. As part of the permission process for all evaluations, a parent or guardian is required to sign a consent form to allow their child's de-identified test results to be used in research. Each participant included in this study has a signed consent form (See Appendix A). See Appendix B for IRB Approval.

Assessment Instruments

Test Of Word Reading Efficiency, Second Edition (TOWRE-2). The purpose of the TOWRE-2 is to assess critical word reading skills. The TWRE Composite score is derived from two subtests. The two subtests are Sight Word Efficiency (SWE), a list of real words, and Phonemic Decoding Efficiency (PDE), a list of nonsense words (Torgesen, Wagner, & Rashotte, 2012). After reading a list of practice words, the examinee has 45 seconds to read as many words as possible from the real words list. Then, the same procedure is complete for the nonsense words. The words increase in difficulty as the examinee reads down the list. An examinee's score reflects both accuracy and speed of word reading (Torgesen, Wagner, & Rashotte, 2012).

Research indicates that the TOWRE-2 is both reliable and valid for this purpose. Both test-retest (.89-.93) and interrater reliability (.99) are high (Tarar, Meisinger, & Dickens, 2015). Regarding validity, correlation coefficients for criterion validity for subtest and composite scores ranged from .89 to .96. The TOWRE-2 manual states that standard scores on this test are usually lower estimates of reading ability than tests that only measure accuracy of word reading. Additionally, samples of students with reading impairments tend to have a larger discrepancy between standard scores on the TOWRE

and standard scores on tests that only measure accuracy of reading than samples from the general population (Torgesen, Wagner, & Rashotte, 2012). These differences between the TOWRE and other measures of word reading accuracy may indicate that the TOWRE is more sensitive to reading disabilities (Tarar, Meisinger, & Dickens, 2015). The first version of the TOWRE had two forms: A and B. Forms C and D were added to the TOWRE-2. The validity research is based on the TOWRE rather than the TOWRE-2, but there were only minor revisions to forms A and B, which are the only forms used at the Tennessee Center for the Study and Treatment of Dyslexia.

Wechsler Individual Achievement Test, Third Edition (WIAT-III).

According to the Wechsler Individual Achievement Test, Third Edition (WIAT-III) manual, the purpose of the WIAT-III is to assess students' academic achievement by measuring listening, speaking, reading, writing, and mathematics (Psychological Cooperation, 2009).

The BRC is derived from two subtests: Word Reading and Pseudoword Decoding. On the Word Reading subtest, real words are presented with increasing difficulty. On the Pseudoword Decoding subtest, words that do not have meaning but use English spelling patterns are presented with increasing difficulty. After 30 seconds, the examiner marks the last item the student finished reading. Based on that number, a percentile rank is given to compare the student to their peers. The percentile rank indicates the student's ability to read and decode fluently compared to peers. Separate standard scores and percentile ranks are given based on how many words and pseudowords the student read

correctly. These standard scores indicate the students' ability to read and decode accurately compared to peers.

An independent test review indicated that the WIAT-III is both reliable and valid (McCrimmon & Climie, 2009). Regarding internal consistency, all composite scores ranged from .90 to .98. Test-retest reliability ranged from .87 to .96 for composite scores. Interrater reliability was between 98 and 99 percent for subtests with objective scoring (either *correct* or *incorrect*), which includes the subtests that make up the BRC. According to McCrimmon and Climie (2009, p. 154), "The final items used in the WIAT-III aligned closely with the theoretical framework of the measure and adequately measure the intended constructs within each domain." Regarding internal structure, correlations between related subtests were as expected (McCrimmon & Climie, 2009). Thus the psychometric properties of both the WIAT-III and TOWRE-2 are adequate.

Procedures

When students are assessed at the Tennessee Center for the Study and Treatment of Dyslexia, a report is written containing the student's background history, assessment details, diagnostic summary, and recommendations. A graph is made for each student with a summary of the different test scores. See Appendix C for a blank sample graph. I reviewed the report and graph for 50 randomly selected cases from Griffith's original sample. Prior to being used in the current study, the Word Reading and Pseudoword Decoding subtest scores from the WIAT-III were deleted from the report and the graph in the files used in the current study. The diagnostic summary and recommendations sections were removed from the report.

Diagnostic decisions were originally made by staff at the Tennessee Center for the Study and Treatment of Dyslexia. Approximately a quarter were determined by Erin Alexander, Assistant Director for Clinical Services, Nationally Certified School Psychologist. Licensed school psychologists and other Assistant Directors (a Speech Language Pathologist and one with a Doctorate degree in Literacy Studies) made the diagnostic decisions for the other students.

For this study, Mark Warner and I, graduate assistants at the Tennessee Center for the Study and Treatment of Dyslexia, made decisions regarding whether students had characteristics of dyslexia. As part of our graduate assistantship, Erin Alexander trained us on what is involved in making a decision regarding the identification of characteristics of dyslexia. Each of us has completed 25 dyslexia evaluations under the supervision of Mrs. Alexander. Additionally, we completed a course and a lab at Middle Tennessee State University (PSY 6750 and 6760) on the assessment and identification of learning disabilities, which includes dyslexia.

As a training trial before data collection started, Mark and I separately completed a Dyslexia Assessment Checklist for three randomly selected files using the students' reports and graphs without WIAT-III results (see appendix D). We used the Dyslexia Assessment Checklist to help us have all of the information on one sheet for each student individually. The form had a place to put test scores, background history, and educational history (e.g., family history of reading and spelling difficulty, history of ear infections, whether he or she has been tutored, what intervention he or she is getting at school, and whether he or she is receiving any special education services and/or

accommodations). We each independently made a decision regarding whether or not each student has characteristics of dyslexia using the checklist. We compared our results to each other using a level of agreement form (see appendix E) to see if our decisions match. Then we discussed our decisions with Mrs. Alexander and compared them to the original decisions regarding whether the students had characteristics of dyslexia.

For the 50 files included in the current study, Mark and I each completed the Dyslexia Assessment Checklist separately to consider the report and graph without the WIAT-III results and made a decision regarding whether or not each student had characteristics of dyslexia. Although it was not needed, if additional information that was not included in the report or graph would have been needed to make a decision, a neutral person (a staff person that works at the center but who was a non-rater) would have looked in the student's file to find the information. I divided the number of cases where we agreed on the diagnosis by the total number of cases to get an inter-rater reliability rate.

Hypothesis testing: A chi-square analysis was conducted comparing the total number of cases for which the diagnostic conclusion remained the same to the number of cases for which the diagnostic conclusion changed.

CHAPTER III

Results

Inter-Rater Reliability

Mark Warner and I, graduate assistants at the Tennessee Center for the Study and Treatment of Dyslexia, separately completed the Dyslexia Assessment Checklist for each student and determined if each student had characteristics of dyslexia. We compared our results and divided the number of cases on which we agreed by the number of total cases. Inter-rater reliability was found to be 96%.

Hypothesis Testing

Hypothesis 1. I predicted that there would not be a significant difference between the diagnostic conclusions reached with and without the use of the WIAT-III Word Reading and Pseudoword Decoding subtests. See Table 2 for a summary. I agreed on the diagnostic conclusion for 86% of the cases. Of the students who were originally identified as having dyslexia, my decision matched for 91.6% of the cases. Of the students who were originally not identified as having characteristics of dyslexia, my decision matched for 80.7% of the cases. I ran a chi-square analysis to compare the number of cases for which the diagnostic conclusion remained the same to the number of cases for which the diagnostics conclusion changed. Results of the chi-square, $\chi^2(1) = 25.42, p < 0.05$, indicated that the distributions of decisions regarding whether each student had characteristics of dyslexia were similar with and without the WIAT-III BRC score. This provides support for Hypothesis 1.

Table 2

Decision Regarding Characteristics of Dyslexia

| | Original Decision | My Decision Matched Original | Accuracy Rate |
|-----------------------------------|-------------------|---------------------------------|---------------|
| Characteristics of Dyslexia | 24 | 22 | 91.6% |
| No Characteristics of Dyslexia | 26 | 21 | 80.7% |
| Total Cases | 50 | 43 | 86% |

N = 50

CHAPTER IV

Discussion

As a graduate assistant at the Tennessee Center for the Study and Treatment of Dyslexia, I saw firsthand the fatigue experienced by many of the students I assessed, especially those with reading disabilities. Assessments usually take a total of five hours, including breaks. For struggling readers, these tests can be frustrating and exhausting, so administering fewer tests would be better for students and logically supports valid testing results. On the other hand, the tests we give each have their own purpose and give useful information that point to a diagnostic conclusion and determine which interventions would be most beneficial. However, there are two tests that we give that measure word reading and decoding (i.e., TOWRE-2 TWRE, WIAT-III BRC). The goal of this study was to see if diagnostic conclusions would be the same if we took two subtests (WIAT-III BRC) out of our battery. My decision to use the WIAT-III is consistent with previous research. Doty, Hixson, Decker, Reynolds and Drevon (2015) chose to use the TOWRE instead of the WIAT-II as a measure of word reading accuracy and fluency.

My findings are similar to Satz and Friel (1978), which found that 90% of children with severe reading disabilities were picked up on the abbreviated battery. Without the use of the WIAT-III BRC score, I came to the same conclusion as the original examiner on 43 of the 50 cases. For five of the seven cases where we did not agree, I came to the conclusion that the students had characteristics of dyslexia, but the original examiner did not. For four of those five cases, the reports noted low scores, but that the weaknesses were not severe enough to be considered dyslexia. Thus, differences

in clinical judgment led to different conclusions. I concluded that there were 27 students with characteristics of dyslexia, but there were only 24 students originally diagnosed. I do not believe that my over-identification was due to the fact that only the TOWRE-2 scores were used. I think the shift in the diagnostic process at the Tennessee Center for the Study and Treatment of Dyslexia had a bigger impact on the differences in diagnostic conclusions in the current study than the elimination of the WIAT-III BRC score. The center shifted from the use of a dichotomous diagnostic process (i.e., you either have dyslexia or not) to a process where students are now described as experiencing characteristics of dyslexia (i.e., one or two mild characteristics of dyslexia would warrant this diagnosis). Thus, the *characteristics of dyslexia* diagnosis criterion is more inclusive. This is the criterion I was trained in and applied to the data in the current study whereas the original diagnostic decision was made based on the dichotomous criterion. Application of different criteria (although the core diagnostic features remain constant) is a logical explanation of why I identified a higher rate of students that had been identified by the original examiners.

There was one case in which I concluded that the student had characteristics of dyslexia because the student had several low scores. The original examiner concluded that the student did not have dyslexia because that student also had significant oral language deficits. This is what researchers call a “mixed reading disability.” Now, we consider this to be included in the characteristics of dyslexia.

There were two cases where the WIAT-III BRC score would have been useful. For one of the two cases my diagnostic decision matched the original decision, but I was

not confident about my decision. For this case, the report noted that the student had a great deal of anxiety when administered the TOWRE-2 and to interpret the results with caution. Therefore, I did not have a valid normative measure of the student's word reading and decoding ability. I felt that the WIAT-III BRC score would have been helpful in determining my diagnostic conclusion, particularly if the student was less anxious when administered this test. In the real world, if the WIAT-III BRC were to be taken out of the standard testing battery, it could still be used when needed in similar cases when the TOWRE-2 scores were not valid.

On the second case (kindergarten student), I concluded that the student did not have characteristics of dyslexia, but the original examiner concluded that the student did have dyslexia. I was not confident in my conclusion. Because this student was so young, I would have liked to have a better idea of the student's word reading and decoding ability without including efficiency and I think that the WIAT-III BRC score would have helped. After I finished with data collection, I looked at the WIAT-III BRC score for this student and it was low. Although I cannot say with certainty, I think that in this case the WIAT-III BRC score may have changed my diagnostic decision.

Overall, it is my belief that the WIAT-III BRC score was needed in only two out of the 50 cases included in this study to clarify diagnostic decisions. It seems that a diagnostic conclusion can be made most of the time using the testing battery of the Tennessee Center for the Study and Treatment of Dyslexia without the use of the WIAT-III BRC. The current study has strong inter-rater agreement and provides statistical support for the elimination for the WIAT-III BRC score. For most cases where the

diagnostic decision did not match, this did not seem related to using only the TOWRE-2 scores. However, there was one student in this study who would have gone without being identified as having characteristics of dyslexia if the WIAT-III BRC score was not considered. Therefore, it is left to the clinical judgment of the examiner to decide whether it is worth the extra time and effort for the 48 students who did not need to complete the WIAT-III BRC to ensure an accurate diagnostic conclusion for all students.

Limitations of the Study

A limitation of this study is that my decision was regarding whether the student had *characteristics* of dyslexia, but the original examiners determined if students had dyslexia. Overall, I think that this continuum shift made more of an impact on the different diagnostic conclusions than the elimination of the WIAT-III BRC score.

Another limitation to this study relates to the trade off between conducting a research study and real world practice. I was not able to consult with anyone when coming to the diagnostic conclusion. Recently, at the Tennessee Center for the Study and Treatment of Dyslexia, we began having case review meetings to work as a team to discuss each case and determine whether we think the student has characteristics of dyslexia and which interventions would be most beneficial. If I had talked out some of the more difficult cases with colleagues, this would have made me more confident in my determinations and have possibly increased my rate of agreement with the diagnostic decisions. However, there was strong inter-rater agreement.

Future Research

At the Tennessee Center for the Study and Treatment of Dyslexia, we determine if students have dyslexia, then we give recommendations for parents and teachers regarding interventions that may be beneficial as well as which accommodations would be most appropriate. In the current study, I looked at whether the diagnostic conclusion would stay the same without the use of the WIAT-III BRC, but I did not look into whether the recommendations for interventions and accommodations would remain the same. Future research in what should be included in the testing battery for dyslexia should not only consider the diagnosis, but intervention planning as well.

This study addresses only a small component of a testing battery for dyslexia. Future research should continue to assess what is needed in a comprehensive testing battery for dyslexia.

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APPENDICES

APPENDIX A: Center for Dyslexia Consent Form

Tennessee Center for the Study and Treatment of Dyslexia
 MTSU P.O. Box 397
 Murfreesboro, Tennessee 37132
 Office: (615) 494 8880 • Fax: (615) 494-8881
 E-mail: dyslexia@mtsu.edu • www.mtsu.edu/dyslexia



Parent's Commitment to Assessment

Assessment involves an evaluation of a student's reading and spelling skills. To provide this service most efficiently, we will need your commitment to the process that will enable the Center to serve the maximum number of children:

1. **Assessment appointments must be kept** unless a request for change in appointment is made in advance, or in an emergency. The Center must be notified of any requested change a week in advance (or immediately should an emergency occur).
2. The Center is engaged in research and continuous study of dyslexia. Your child's test scores may be used for research. At no time will a child's name be used publicly without an additional release in writing.
3. The Center is a training facility. Therefore, your child's assessment could be conducted by a graduate student. Our graduate assistants have received thorough training in procedures for identifying dyslexia, and if your child is tested by a graduate student, the evaluation process will be supervised by the Center's Assistant Director for Clinical Services. This supervisor will carefully review your child's case before testing, will consult on interpretation of test results, and will review the written report of findings before the report is prepared for mailing.

If you understand and accept these conditions for assessment, kindly sign the statement below and return it to the Center.

Re: _____
 (Student's Name)

I understand and agree with the above commitment to assessment.

 Parent's / Legal Guardian's Signature

 Date

APPENDIX B: Institutional Review Board Approval

IRB
INSTITUTIONAL REVIEW BOARD
 Office of Research Compliance,
 010A Sam Ingram Building,
 2269 Middle Tennessee Blvd
 Murfreesboro, TN 37129



IRBN007 – EXEMPTION DETERMINATION NOTICE

Wednesday, January 24, 2018

Investigator(s): Kelee Cruz; Mark Warner; Monica Wallace
 Investigator(s) Email(s): knd3b@mtmail.mtsu.edu; maw5y@mtmail.mtsu.edu;
 monica.wallace@mts.edu
 Department: Psychology
 Study Title: ARE BOTH THE TOWRE-2 AND BASIC READING SCORES FROM
 THE WIAT-III NEEDED TO ACCURATELY DIAGNOSE DYSLEXIA?
 Protocol ID: **18-1128**

Dear Investigator(s),

The above identified research proposal has been reviewed by the MTSU Institutional Review Board (IRB) through the **EXEMPT** review mechanism under 45 CFR 46.101(b)(2) within the research category (4) *Study involving existing data*. A summary of the IRB action and other particulars in regard to this protocol application is tabulated as shown below:

| | | |
|-------------------------|--|---------------------------------|
| IRB Action | EXEMPT from further IRB review*** | |
| Date of expiration | NOT APPLICABLE | |
| Participant Size | Existing Data | |
| Participant Pool | Existing Data from protocol ID: 17-1037 | |
| Mandatory Restrictions | Only de-identified data collected under MTSU IRB protocol ID 17-1037 may be analyzed | |
| Additional Restrictions | None at this time | |
| Comments | None at this time | |
| Amendments | Date | Post-Approval Amendments |
| | | None at this time |

***This exemption determination only allows above defined protocol from further IRB review such as continuing review. However, the following post-approval requirements still apply:

- Addition/removal of subject population should not be implemented without IRB approval
- Change in investigators must be notified and approved
- Modifications to procedures must be clearly articulated in an addendum request and the proposed changes must not be incorporated without an approval
- Be advised that the proposed change must comply within the requirements for exemption
- Changes to the research location must be approved – appropriate permission letter(s) from external institutions must accompany the addendum request form
- Changes to funding source must be notified via email (irb_submissions@mts.edu)

APPENDIX B: Institutional Review Board Approval Continued

Institutional Review Board

Office of Compliance

Middle Tennessee State University

- The exemption does not expire as long as the protocol is in good standing
- Project completion must be reported via email (irb_submissions@mtsu.edu)
- Research-related injuries to the participants and other events must be reported within 48 hours of such events to compliance@mtsu.edu

The current MTSU IRB policies allow the investigators to make the following types of changes to this protocol without the need to report to the Office of Compliance, as long as the proposed changes do not result in the cancellation of the protocols eligibility for exemption:

- Editorial and minor administrative revisions to the consent form or other study documents
- Increasing/decreasing the participant size

The investigator(s) indicated in this notification should read and abide by all applicable post-approval conditions imposed with this approval. [Refer to the post-approval guidelines posted in the MTSU IRB's website.](#) Any unanticipated harms to participants or adverse events must be reported to the Office of Compliance at (615) 494-8918 within 48 hours of the incident.

All of the research-related records, which include signed consent forms, current & past investigator information, training certificates, survey instruments and other documents related to the study, must be retained by the PI or the faculty advisor (if the PI is a student) at the secure location mentioned in the protocol application. The data storage must be maintained for at least three (3) years after study completion. Subsequently, the researcher may destroy the data in a manner that maintains confidentiality and anonymity. IRB reserves the right to modify, change or cancel the terms of this letter without prior notice. Be advised that IRB also reserves the right to inspect or audit your records if needed.

Sincerely,

Institutional Review Board
Middle Tennessee State University

Quick Links:

[Click here](#) for a detailed list of the post-approval responsibilities.
More information on exempt procedures can be found [here](#).

APPENDIX C: Blank Student Profile Graph

| | | | | | |
|--|---|-------------|---------|--------------|----------|
| <p>Center for the Study and Treatment of Dyslexia Middle Tennessee State University PO Box 397 - 200 North Baird Lane Murfreesboro, TN 37132 (615) 494-8880</p> | <p>POST-ASSESSMENT STUDENT SCORE PROFILE</p> <p>Please see assessment report for more details, other tests given, diagnostic conclusion, and recommendations. All decisions regarding special education eligibility belong to the school IEP team.</p> | | | | |
| <p>Name:</p> | | | | | |
| <p>Date:</p> | | | | | |
| <p>Age:</p> | WJ-III NU Written Expression SS= (Writing Samples SS= , Writing Fluency SS=); DIBELSNext: wcpm, Accuracy | | | | |
| <p>Grade:</p> | Scores reported are Standard Scores | | | | |
| | 60-79 | 80-89 | 90-109 | 110-119 | 120-129 |
| | Very Low /Low | Low Average | Average | High Average | Superior |
| Intelligence (IQ) | | | | | |
| <small>WISC-IV</small> | | | | | |
| Listening Comprehension | | | | | |
| <small>WIAT-III</small> | | | | | |
| Reading Comprehension | | | | | |
| <small>WIAT-III</small> | | | | | |
| Reading Real Words | | | | | |
| <small>WIAT-III Word Reading; TOWRE2</small> | | | | | |
| Decoding Nonsense Words | | | | | |
| <small>WIAT-III Pseudoword Decoding; TOWRE2</small> | | | | | |
| Oral Reading Fluency | | | | | |
| <small>WIAT-III</small> | | | | | |
| Spelling | | | | | |
| <small>WIAT-III</small> | | | | | |
| Phonological Awareness | | | | | |
| <small>CTOPP-2 PA, AII, PA</small> | | | | | |
| Phonological Memory | | | | | |
| <small>CTOPP-2</small> | | | | | |
| Rapid Symbolic Naming | | | | | |
| <small>CTOPP-2</small> | | | | | |

APPENDIX D: Dyslexia Assessment Checklist

Dyslexia Checklist Directions

Use the students report to fill out the checklist. Use assessment scores to fill in the first half of the chart. Below is a list of score descriptors for each test. Write the assessment scores in the appropriate columns depending on whether the score is below average or not. Use the background section to fill in the bottom half of the chart starting at family history. If “yes” is checked and there is a narrative box, please fill in the box. Once the chart is complete, circle “yes” or “no” to indicate whether or not the student displays characteristics of dyslexia.

CTOPP-2 and TOWRE-2 (Composite Scores)

| <i>Standard Score</i> | <i>Descriptor</i> |
|-----------------------|-------------------|
| 131-165 | Very Superior |
| 121-130 | Superior |
| 111-120 | Above Average |
| 90-110 | Average |
| 80-89 | Below Average |
| 70-79 | Poor |
| 35-69 | Very Poor |

RAN/RAS Test Composite Scores

| <i>Standard Score</i> | <i>Descriptor</i> |
|-----------------------|-------------------|
| > 130 | Very Superior |
| 121-130 | Superior |
| 111-120 | Above Average |
| 90-110 | Average |
| 80-89 | Below Average |
| 70-79 | Poor |
| < 70 | Very Poor |

WIAT-III Subtest and Composite Scores (use this for PAT-2 also)

| <i>Standard Score</i> | <i>Descriptor</i> |
|-----------------------|-------------------|
| Above 145 | Very Superior |
| 131-145 | Superior |
| 116-130 | Above Average |
| 85-115 | Average |
| 70-84 | Below Average |
| 55-69 | Low |
| Below 55 | Very Low |

Student #:

Age:

Grade:

| | yes | no | Narrative Please note any subtest scores that are inconsistent with composite scores. |
|---|-----|----|--|
| (above) Average IQ | | | |
| (above) average listening comprehension | | | |
| Below average reading comprehension | | | |
| Below average word reading efficiency | | | |
| Below average decoding efficiency | | | |
| Below average reading at text level (accuracy and rate) | | | |
| Below average spelling | | | |
| Below average phonological awareness | | | |
| Below average phonological memory | | | |
| Below average rapid automatic naming | | | |
| Other relevant test scores | | | |
| Family history | | | |
| Concussion | | | |
| History of ear infections/tubes | | | |
| Birth complications | | | |
| Retained | | | Which grade: |
| Homeschooled | | | Which grade(s): |
| Intervention at school | | | Which grade(s): What program: |
| Tutoring | | | Which grade(s): Skills: |
| IEP/504 | | | Category: |
| Speech/language concerns | | | Current or historical? |
| Other health concerns (ADHD, etc.) | | | |
| Currently on medication | | | For: |
| Other relevant information | | | |

Characteristics of Dyslexia:

YES

NO

APPENDIX E: Level of Agreement Form

| Student # | Kelee | Mark | Agree (yes/no) |
|---|--------------------------------|-----------------------------|----------------|
| 1 | Characteristics of dyslexia | Characteristics of dyslexia | yes |
| Discussion: | | | |
| 2 | No characteristics of dyslexia | Characteristics of dyslexia | no |
| Discussion: This student only had a few low scores. In discussion we determined that this student had mild characteristics of dyslexia. | | | |
| 3 | Characteristics of dyslexia | Characteristics of dyslexia | yes |
| Discussion: | | | |