MEASUREMENT VALIDATION AND EXPLORATORY RESEARCH: MEASURING TEACHERS' CODE KNOWLEDGE AND ITS ASSOCIATION WITH DYSLEXIA THERAPY CLINICAL HOURS AND CONFIDENCE TO TEACH LITERACY

by

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In memory of my beloved son, Maxwell William McMahan,

who inspired my life work because of his struggles with dyslexia.

May you live on through my research and writings.

I love and miss you.

Pro gloria Dei.

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ABSTRACT

In an effort to provide free and appropriate education for students, 42 states have passed laws regarding dyslexia, many of which address the instructional requirements of reading intervention. Programs were developed to train teachers in dyslexia specific instruction. However, there is limited research examining the efficacy of this training. In order to explore this area, psychometrically validated measures are essential. However, no measure was located with equal distribution of items across the basic elements of English language (phonological sensitivity, phonemic awareness, decoding, encoding, and morphology) so that categories could be compared. Therefore, it was necessary to draft and psychometrically validate such measure, including assessing the reliability of the measure to discriminate between teachers with two years of dyslexia therapy training and those with no training. Three hundred and eighty-eight educators participated in the psychometric validation and the discriminant analysis. Then to explore the instrument's research potential, 382 K-12 certified teachers' calibrated scores were used to investigate the impact of the interaction between knowledge and clinical hours teaching struggling readers on teachers' confidence to teach literacy. The validated measure demonstrated that distinguishes differences in knowledge between those teachers who have completed two years of dyslexia therapy training and those who have no training. Additionally, the instrument proved successful in a moderation regression analysis that examined the effect of knowledge of the basic elements of English language on clinical hours impact on confidence. Laws may designate what teachers are required to teach, but laws in and of themselves do not change people. Training is an integral element to informing teachers of new information, but training alone does not readily transfer to effective classroom

instruction. Therefore, it is important to continue to examine teacher knowledge and experiences working with struggling readers as but one aspect of impacting students' academic achievement.

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ABBREVIATIONS

IDA - International Dyslexia Association

IES – Institute of Education Science

NAEP – National Assessment of Educational Progress

NAGB – National Assessment Governing Board

NICHD – National Institute of Child Health and Human Development

NPR – National Reading Panel

WWC – What Works Clearinghouse

CHAPTER I

INTRODUCTION

Overview

People agree reading is a vital life skill wherein the ability or the lack thereof often sets the trajectory for educational attainment, wage earnings, and social emotional health. Given the significant contribution of reading to life outcomes, it stands to reason that early reading success for students is an important objective of a nation. As a society, reading improvement initiatives cross private and public sectors in the hopes of improving reading for all students (e.g. IDA, IES, and NICHD). This concerted effort demonstrates significant human strides toward advancing literacy. Nonetheless, acquiring proficient reading evades many students in the United States. This is not a new problem. In 1999, Lyon testified to Congress on behalf of the National Institute of Child Health and Human Development (NICHD) that around 60% of children found learning to read a "formidable challenge" (2002, p. 1). Fast forward almost two decades later, and the acquisition of early reading proficiency remains a challenge for a significant populous of students. The Nation's Report Card of the 2017 National Assessment of Educational Progress (NAEP) reported that 63% of fourth graders read below a proficient level while fourth grade students at or below the twenty-fifth percentile performed significantly ($p < .05$) lower in reading for 2017 than in 2015 (NAEP, 2018). According to the Nation's Report Card, acquiring proficient reading in the early grades is a problem especially for struggling readers.

Students may struggle to acquire proficient reading due to dysteachia or dyslexia or both. Dysteachia is a term used to denote insufficient and ineffective teaching practices (Binks-Cantrell & Joshi, 2015). Dysteachia arises because teachers lack the explicit knowledge of the science of reading and often continue to use outdated classroom practices (Brady & Moats, 1997; Lyon, 1997; NAGB, 2018). Students may also struggle to acquire fluent reading due to dyslexia. Dyslexia is defined as:

> a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge. (IDA, 2012)

Systematic code instruction delivered by knowledgeable teachers benefits both early grade students and struggling readers (Moat & Lyon, 1996). In fact, Piasta, Conner, Fishman, and Morrison (2009) found that a deficit in teacher knowledge was not alleviated through the use of a highly effective scripted curriculum, a finding replicated by Cohen, Mather, Schneider, and White (2017). However, many teachers face reading instruction underprepared, lacking explicit code knowledge that often leads to inefficient instructional practices (Binks-Cantrell, Washburn, Joshi, & Hougen, 2012; Cunningham, Perry, Stanovich, & Stanovich, 2004; Moats, 1994). Additionally, mega meta-analysists Hattie and Zierer (2018) propose that “how” teachers think about their instructional

practices is as important as "what" teachers teach. This suggests that it is important to better understand the role of teachers' pedagogical confidence, degree of knowledge, and whether hands on experience working with struggling readers impact teachers' confidence in their efficacy. Therefore, this study aims to contribute to quantitative teacher knowledge research by providing a multi-form validated instrument for use in assessing teacher knowledge of early literacy constructs. Additionally, the impact of contact hours working with struggling readers and the interaction with knowledge of the basic elements of English language on teachers' confidence will be examined.

Background

No phonics requirement

Despite being home to the world's largest native English speaking populous, the United States does not require explicit and systematic phonics instruction as part of a comprehensive reading program in the early grades. On the other hand, England mandates the use of systematic phonics instruction (Castles, Rastle, & Nation, 2018). According to national statistics, England observed a 141% increase in the percent of students attaining the reading standard since the mandate's inception: 2012 58%, 2013 69%, 2014 74%, 2015 77%, 2016 81%, 2017 81%, and 2018 82% (U.K. Department of Education, 2018). The increasing levels in decoding performance suggest that as teachers gain the knowledge and experience teaching systematic phonics, the greater their "quality of delivery" (Castles et al., 2018, p. 13). Furthermore, impact analysis suggested the teaching of phonics in Years 1 and 2 benefited struggling readers' comprehension performance through Year 7 or sixth grade by U.S. standards (Castles et al., 2018; Machin, McNally, & Viarengo, 2016). The benefit of systematic phonics instruction for

struggling readers and implied benefit in teachers' effectiveness are not without opposition despite empirical evidence.

The title of Castles, Rastle, and Nation (2018) research synthesis reveals the difficulties teachers face in teaching reading: "Ending the Reading Wars: Reading Acquisition from Novice to Expert". The term war denotes tension and rivalry, and in this case the war is over teaching reading through whole language or explicit phonics. Why should there be reading "wars" when sufficient quantitative research reveals what works in teaching foundational literacy skills? In fact, several meta-analyses spanning two decades demonstrated the positive impact of systematic instruction in phonics and early literacy constructs on reading acquisition (Foorman et al., 2016; Hattie, 2012; National Reading Panel, NPR, 2000). The NPR (2000) concluded that systematic phonics instruction ($d = 0.44$) was significantly better than nonsystematic or no phonics instruction. Hattie's (2012) mega meta-analyses concluded phonics ($d = 0.54$) was nearly 10 times as effective as whole language ($d = 0.06$). The U.S. government sponsored Institute of Education Science (IES) produced findings from What Works Clearinghouse (WWC) that systematic instruction in foundational skills was highly effective (Foorman et al., 2016). The IES's recommendation, "teach students to decode and recognize words and word parts," omitted the reference to systematic phonics instruction despite the meta-analyses including studies employing systematic phonics (Foorman et al., 2016, p. 28). Nonetheless, the how to examples provided suggest teaching letter sound correspondence in a sequenced manner and to use sounding out, blending, or chunking techniques to decode words thereby avoiding the use of the controversial term—systematic phonics instruction.

While there is significant evidence supporting phonics instruction in the early grades and in supporting students with word level reading weakness, some studies have noted a negative impact from the use of phonics instruction by teachers with weak knowledge of the basic elements of English. Piasta, Conner, Fishman, and Morrison (2009) observed that teachers with less knowledge of the structure of English who implemented decoding instruction at the same level and intensity of more knowledgeable teachers produced students with the weakest word level reading scores. It may be that the use of a scientific based scripted code instruction curriculum could help overcome the negative impact of phonics instruction taught by a teacher with low knowledge of the structure of English language. Cohen, Mather, Schneider, and White (2017) examined 114 kindergarten through third grade teachers from similar ranking schools. One group of teachers were from schools that implemented explicit code instruction with a scripted curriculum and the other group of teachers were from schools that did not use explicit code instruction. Surprisingly, there were no significant differences in the teachers' students' state level reading scores between the groups. Additionally, both groups of teachers scored low in level of knowledge of the structure of English and were not significantly different. While explicit code instruction has been shown to positively impact word level reading gains in the early grades and with struggling readers, phonics taught by teachers with less knowledge of the structure of the English language does not confer the same benefit.

The discontinuity between empirical research in systematic phonics instruction and teachers' knowledge of early literacy components is a problem that requires addressing. Binks-Cantrell, Washburn, Joshi, and Hougen (2012) referred to this

problem as the Peter Effect. They noted that the level of knowledge of basic language constructs of teacher educators was in proportion to their preservice teachers (PST) and concluded teacher educators could not transfer knowledge to their students if they did not have the knowledge. Additionally, classroom teachers' level of code knowledge informs instructional practices that in turn impact students' word level reading ability either positively or negatively (Castles et al., 2018; McCutchen & Berninger, 1999; Piasta et al., 2009). While national oversight committees recognize the contribution of ineffective teachers to the literacy crisis, national laws requiring systematic code instruction and the ramifications this would have in teacher preparation remain just a noble idea.

Teachers' knowledge and dyslexia laws

Without a national policy requiring systematic code instruction in the early grades, incentives to implement phonics based instructional practices or to require explicit code knowledge of teachers remains a problem in the U.S. despite mounting evidence demonstrating effectiveness (e.g. Foorman et al., 2016; Hattie, 2012). Some struggling readers may be affected by dyslexia, a specific learning disability of neurobiological origin denoted by disfluent word decoding that often responds well to targeted early intervention (Foorman, Francis, Shaywitz, Shaywitz, & Fletcher, 1997; IDA, 2012). In an effort to provide free and appropriate education to students at risk of reading failure due to dyslexia, many states adopted dyslexia specific laws (Youman & Mather, 2012, 2015, 2018).

Forty-two states have laws related to dyslexia with several states specifying specific content requirements and training for teachers that work with students with characteristics of dyslexia (Youman & Mather, 2012, 2015, 2018). A major potential

obstacle in executing the instructional requirements in dyslexia laws arises at the very level of contact with students—the teacher. Historically, researchers (e.g. Cunningham et al., 2004, Moats 1994) demonstrated teachers lack the specific knowledge required to implement the requirements of dyslexia specific instruction. For example, Tennessee passed a law that defines dyslexia specific intervention:

> evidence-based specialized reading, writing, and spelling instruction that is multisensory in nature equipping students to simultaneously use multiple senses, such as vision, hearing, touch, and movement. Dyslexia-specific intervention employs direct instruction of systematic and cumulative content, with the sequence beginning with the easiest and most basic elements and progress methodically to more difficult material. Each step must also be based on those already learned. Components of dyslexia-specific intervention include instruction targeting phonological awareness, sound symbol association, syllable structure, morphology, syntax, and semantics. (TN Code § 49-1-229 (f) (1))

While laws delineating the requirements of dyslexia specific intervention are promising, current research notes that teachers still lack the explicit knowledge to carry out the requirements delineated in such laws. In their examination of 347 licensed teachers from states with dyslexia laws, McMahan, Oslund, and Odegard (2019) found the average performance of basic English language knowledge for teachers who had not received dyslexia specific intervention instruction was 56.8%. Furthermore, Folsem, Smith, Burk, and Oakley (2017) reported overall performance in reading constructs as 51.25%, and Cohen et al. (2017) reported knowledge performance of 67.24%. Given that researchers (e.g. Cohen et al., 2017; Piasta et al., 2009) noted a negative impact to

students' reading scores when systematic code instruction was delivered by teachers with low levels of knowledge in the structure of English, these current reports of low levels of construct knowledge of English suggest that a teacher's ability to implement the requirements of dyslexia specific instruction laws is hindered by their level of knowledge and subsequent ineffective instructional practices. To address this potential obstacle, some state laws require special training for teachers who work with students with characteristics of dyslexia.

Training requirements differ by state law ranging from "additional training" to advanced certification beyond initial teacher licensure (CT HB1054; Mississippi Department of Education, 2010; TN SB 2635). For example, Mississippi offers dyslexia therapy certification after initial teacher certification, and Texas provides a Licensed Dyslexia Practitioner or Licensed Dyslexia Therapist option (Mississippi Department of Education, 2010; Texas Department of Licensing and Regulations, 2016). Therapy level training requires 200 instructional hours over two years with a minimum of 700 hours of supervised clinical practice implementing reading intervention with a variety of students with characteristics of dyslexia (Texas Department of Licensing and Regulations, 2016).

On the other hand, some state laws denote the provision of appropriate professional development without clear descriptions of what training should encompass (e.g. TN SB 2635). Furthermore, few studies have examined the impact of specific requirements of dyslexia specific training on teachers' knowledge and confidence to teach literacy, a reflection of "how" teachers think about their practice (Hattie & Zierer, 2018). McMahan, Oslund and Odegard (2019) found teachers who held dyslexia specific certification had significantly greater knowledge of foundational literacy constructs than

untrained teachers despite level of degree held or number of years of teaching experience. However, to date there remains insufficient research to characterize the efforts of states to require specialized training or certification in dyslexia specific instruction.

The need for training in the science of English

Specific training to teach foundational concepts of the English language is warranted (Moats, 1994, 2009a, 2009b). Unlike more transparent languages where sound symbol correspondence is straight forward, English is characterized as a language of deep orthography (King, 2000). This deep orthography may lead to false conclusions of English as an inconsistent language and result in inconsistent or confusing instructional practices (Spear-Swerling & Cheeseman, 2012). As an alphabetic language, English's 26 letters account for approximately 44 sounds spelled 98 ways depending on situation and word origin (Gillingham, 1956; Henry, 2010).

Vowels are influenced by syllable type, accent, and adjacent letters (Gillingham, 1956; Moats, 2010). For example, the letter "a" has several sounds. In a closed syllable, "a" is short as in "cat". In an open accented syllable, "a" is long and says its name as in "apron". In an open unaccented syllable, "a" produces the schwa sound as in "about". Letters before or after "a" impact its pronunciation as well such as the "w" in "wash" or the "l" in "salt". Consonant sounds may vary in relation to letters following or position within a word. For example, the letter "c" is hard before a, o, u, or consonants as in "cat", but is soft before e, i, or y as in "city". Similarly, "g" has hard and soft sounds, but is not always soft before e or i as in "gel" and "geese" or "giraffe" and "gift". The letter "x" changes sound by position within the word such as "fox" and "xylophone". Grapheme-phoneme correspondences in English follow generalizations that typically

require explicit instruction for teachers to acquire (Scarborough, Ehri, Olson, & Fowler, 1998).

Spelling of phonemes demonstrates reliable situations as well (Hanna, Hanna, Hodges, & Rudorf, 1966). For example, the spelling of /k/ varies by position, context, and word origin. In the initial or medial position, "k" is used to spell /k/ before e, i, or y, and "c" is used before a, o, u, or a consonant. In the final position after a short vowel, digraph "ck" is used in a one syllable base word as in "duck" and "c" is used in a multisyllabic word such as "music". In the final position after a consonant as in "milk" or two vowels as in "book", the spelling of /k/ requires a "k". Students memorize "school" in the third 100 Fry sight word list and typically do not learn the association of Greek word origin and the spelling of /k/ with digraph "ch" until later. Phoneme-grapheme correspondence varies, but in-depth knowledge of spelling generalizations and rules provides a strong foundation to inform instructional practices (Carreker, Joshi, Boulware-Gooden, 2010; Hanna et al., 1966).

With a language of such deep orthography, an understanding of the science of English provides reading teachers and interventionists with the knowledge necessary to teach a complex language directly and explicitly with confidence to students acquiring word level reading skills. Explicit knowledge of sound symbol correspondences is not the only knowledge that impacts teaching reading. Phonology knowledge also is important. Struggling readers such as those with dyslexia demonstrate difficulty differentiating between subtle differences in phonemes (Paulesu et al., 1996; Tallal, 1980). For example, a student may confuse /k/ and /g/ or /p/ and /b/. Teachers with explicit knowledge of place, manner, and voicing of the approximately 44 English

phonemes would recognize the phoneme confusion as cognates and understand the error related to voicing. Explicit knowledge in phonology allows teachers to recognize error types and provide informed instructional practice (Scarborough et al., 1988).

While the knowledge of the intricacies of the English language may seem irrelevant to teaching systematic and explicit reading, researchers continue to report the necessity of in-depth teacher knowledge of early literacy constructs (Lyon & Weiser, 2009; Moats, 2009a; Piasta et al., 2009). While it is noted that a teachers' reading proficiency does not equate to possessing the explicit knowledge required to teach reading (Phelps, 2009; Scarborough et al., 1998), the question remains: What training methods impart the knowledge base necessary to alter teachers' knowledge of the basic elements of English language? Therefore, it is important to continue to measure teacher knowledge in early literacy constructs in conjunction with intensive reading intervention training to examine the benefits of such training and justify if the investment of time and financial resources is warranted.

Purpose

The understanding that teachers lack construct knowledge of the components of the English language is not new. Moats (1994) recognized the weaknesses in teachers' knowledge of the elements of spoken and written English. Despite over two decades of research since Moats' original conclusions, teachers continue to find themselves on the frontline of a reading war without adequate knowledge to inform their instructional practices in early literacy and word level reading intervention (Carreker et al., 2007; Lyon & Weiser, 2009; Moats, 2009b; Washburn, Joshi & Binks-Cantrell, 2011). Subsequently, organizations developed models of intensive training for teachers of

reading and more specifically teachers who work with students with word level reading deficits including dyslexia. These models of training have limited research to assess effectiveness at altering teachers' knowledge of the basic elements of English (phonology and orthography) and the impact this knowledge has on instructional practices or student reading outcomes. While assessing student outcomes in association with teachers' knowledge is vital, this study was limited to exploratory observation at the teacher level. To address the need to examine efficacy of training and the association of training models to teachers' knowledge and confidence to teach literacy, two studies were conducted.

Study 1

The first study was a validation study of a multi-form instrument of code level knowledge and skill components. The first aspect of this study employed item response theory (IRT) to psychometrically validate items covering phonological sensitivity, phonemic awareness, decoding, encoding, and morphology, which is collectively referred to here as basic elements of English language (BEEL). Developing a validated instrument is but one aspect of measuring response to training. It is important for the instrument to aid in the differentiation between teachers with two years of dyslexia therapy training and those with no training as a prognostic indicator of the instrument's ability to measure knowledge growth over time points in training. Therefore, the second step of the validation study examined the discriminant function involving the calibrated instrument to assess the accuracy in classifying teachers as those who have two years of dyslexia therapy training and those who have none. The following research questions guided this study:

- Does Form A have acceptable reliability indices according to CTT?

- Does Form B have acceptable reliability indices according to CTT?
- Does Form A have acceptable psychometric properties according to IRT analysis?
- Does Form B have acceptable psychometric properties according to IRT analysis?
- How accurate is the discriminant analysis function using IRT scoring in differentiating teachers who have two years of dyslexia therapy training and those who have none?

Study 2

A second study examined the relationship between the level of clinical hours teachers work with struggling readers and confidence to teach literacy. Additionally, we explored the interaction between knowledge of basic elements of English language (BEEL) and clinical hours on the outcome of teachers' confidence to teach literacy. Based on a review of the literature, it was hypothesized clinical hours working with struggling readers would positively impact teachers' confidence to teach literacy. Furthermore, given the association between teachers' level of code knowledge and confidence to teach reading in the literature, we further hypothesized that knowledge would interact with clinical hours impact on confidence.

The following research questions will guide this study:

- Are there differences in confidence to teach literacy among teachers with varying clinical hours working with students with characteristics of dyslexia?
- How does the effect of clinical hours on teachers' confidence vary based on teachers' knowledge of the basic elements of English?
    - What it the effect of clinical hours on confidence?
    - What is the effect of knowledge on confidence?

- What is the conditional effect of clinical hours as moderated by knowledge on confidence?

Definitions

Before moving forward, there are terms to define. Moats (1994) used the term linguistic knowledge, and Washburn, Joshi, and Binks-Cantrell (2011) introduced the term basic language constructs. Others use structure of language (e.g. Mather, Bos, & Babur, 2001; Spear-Swerling & Brucker, 2003). These terms refer to the basic elements of English: phonology (sound) and orthography (writing). Phonology refers to the sounds of language. Both the knowledge and ability to recognize the sound patterns in language is phonological awareness. Phonemic awareness, a component of phonological awareness, is the knowledge of and ability to notice and or manipulate the smallest unit of sound (phoneme) that if changed alters a word. To designate an awareness of units of sound larger than a phoneme, the term phonological sensitivity is used (IDA, 2018).

Orthography is the written system of a language that includes phonics and morphology. Phonics is the association between letters and sounds and can also refer to an approach to teach decoding (reading) and encoding (spelling) focusing on sound symbol correspondence. Phonics is also referred to as code knowledge or code instruction. At the basic of levels, students learn to associate sounds (phonemes) with letters (graphemes). The next step up is units of meaning. A morpheme is the smallest unit of meaning. A morpheme can be a word such as rabbit or parts of a word such as adding s to make rabbit plural. Therefore, the word rabbits contains two morphemes (rabbit + s). Finally, the study of morphemes is morphology.

These basic elements of English, phonology and orthography comprised of phonological sensitivity, phonemic awareness, decoding, encoding, and morphology, are collectively referred here as BEEL. BEEL implies the smallest elements or foundational concepts comprising the knowledge needed to acquire word level reading and spelling, which some children do with relative ease and others require explicit and systematic instruction (Moats, 1994).

CHAPTER II

ARTICLE I

VALIDATION OF BASIC ELEMENTS OF ENGLISH LANGUAGE: A TEST OF KNOWLEDGE FOR WORD LEVEL INTERVENTION

Abstract

Although students learning to read initially and those with word level reading weaknesses benefit from systematic and explicit reading instruction, few teachers receive training in explicit code knowledge and instructional methods. To examine the degree of benefit of training to convey code-based knowledge calls for a multi-form assessment tied to a generalized body of word level reading standards. The purpose of this study was to validate test items for the *Basic Elements of English Language: A Test of Knowledge for Word Level Intervention* (*BEEL*) leveraging the power of item response theory (IRT) to provide a psychometrically validated instrument sensitive enough to discriminate across levels of knowledge. We randomized 388 educators to one of two 50-item surveys covering phonological sensitivity, phonemic awareness, decoding, spelling, and morphology. IRT analysis was conducted, and the best IRT model was selected for the data. Two high reliability 50-item surveys containing several items with strong discrimination ability and item difficulty were constructed. Calibrated items were used to calculate participants' theta scores. Discriminant analysis examined the contribution of performance on the *BEEL* to predict group membership. Discriminant analysis and subsequent t-test demonstrated the measure could reliably differentiate between teachers

with no dyslexia training and those with two years of training. Psychometrically validated measures aid research initiatives. We propose that the *BEEL* survey will assist researchers examining teachers' code knowledge and instructional practices yet recognize that teachers' code knowledge is part of a larger equation to raise student reading achievement.

The earlier a reading deficiency is identified and targeted with appropriate instruction, the sooner the world of print is opened for a student to learn (Ferrer et al., 2015). Reading serves as the key to the door of opportunity in school to acquire knowledge and outside of school to aid in the development of contributing members of society. The vital importance reading plays in both school and life, drives society's quest to improve reading and literacy levels for all students.

Many states have adopted a multi-tiered system of support (MTSS) to systemize student support. Response to intervention (RTI), a component of MTSS, provides instructional support at varying levels and intensities to assist students who require additional skills-based instruction (Pullen, van Dijk, Gonsalves, Lane, & Ashworth, 2019). Recommendations for tiered intervention in reading suggest teaching foundational skills that target students' weaknesses (Gersten et al., 2009). Instruction that targets students' weaknesses inherently implies the need for teachers to possess the foundational knowledge necessary to teach the targeted skills (Binks-Cantrell, Washburn, Joshi, & Hougen, 2012; Moats & Lyon, 1996). However, researchers continue to report the weaknesses in teachers' knowledge of word level components (e.g. Cohen, Mather, Schneider, & White, 2017; Folsom, Smith, Burk, & Oakley, 2017; McMahan, Oslund, & Odegard, 2019). While knowledge of word level components may be seen essential for early elementary teachers only, research with adolescent readers reveals otherwise. Oslund, Clemens, Simmons, and Simmons (2018) observed the direct role word level reading contributed to reading comprehension for struggling readers and suggested differentiation of instruction to address word level skills. Indeed, research suggests

reading teachers require explicit knowledge necessary to provide initial and differentiated instruction at the word level.

Literature Overview

Explicit knowledge

Explicit knowledge of reading and constructs of code instruction, the basis of word reading acquisition, is a contributing factor to effective teaching practices (Ehri & Flugman, 2018; Lyon & Weiser, 2009; Moats & Foorman, 2003). Ehri and Flugman (2018) noted knowledge of foundational literacy constructs as observed during instruction positively impacted student decoding. Carreker, Joshi, and Gooden (2010) found that teachers with higher levels of knowledge selected appropriate instructional targets in addressing student errors. Moreover, McCutchen and colleagues (2002, 2009) reported that as teacher knowledge increased teachers' instructional practices improved and predicted student word reading gains. Furthermore, the National Assessment Governing Board's reading panel implicated teachers' instructional practices as a primary target to improving reading achievement (NAGB, 2018). Given that instructional practices are noted to change in response to an increase in teachers' knowledge that in turn positively impacts students' decoding (Ehri & Flugman, 2018), continuing to rigorously examine teachers' knowledge in response to educational coursework and professional development remains warranted.

The need for psychometrically validated measures

In quantitative research, whether experimental or non-experimental in design, employing psychometrically validated measures to assess progress and effectiveness of an intervention aids in the ability to replicate findings (Gall, Gall, & Borg, 2006).

Replication of research is important to confirm effective interventions. However, the construct of reading teacher knowledge has proved difficult to measure (Phelps & Schilling, 2004), and assessment options vary in domains measured (e.g. *Teacher Knowledge of Reading and Reading Practices*; Carlisle, Kelcey, Rowan, & Phelps, 2011; *Informal Survey of Linguistic Knowledge*; Moats, 1994). Given the focus of knowledge needed for word level instruction, an examination of surveys measuring the basic elements of English language (BEEL) was conducted. BEEL refers to the basic elements of the English language: phonology and orthography that can be deconstructed as phonological sensitivity, phonemic awareness, decoding, encoding, and morphology.

A PsycInfo and Eric database search of peer reviewed articles using the parameters 'teacher knowledge' and 'reading' resulted in 964 articles of which 250 were empirical studies written in English. Additional searches with 'teacher knowledge and phonics' and 'teacher knowledge and code instruction' yielded 3 additional studies not captured in the initial search. Reading the abstracts reduced articles to review to 36. However, search criteria did not capture seminal papers such as Moats (1994), Moats and Lyon (1996), McCutchen and Berninger (1999), Bos, Mather, Dickson, Podhajski and Chard (2001), Mather, Bos, and Babur (2001), and McCutchen et al. (2002). Articles before 2003 used keywords such as 'reading instruction' and 'teacher education'. Therefore, an additional search with these parameters was conducted, leading to the addition of 6 papers. A further search of references produced another 7 publications, and a hand search added 1. Fifty papers were coded to examine measures containing both phonological awareness and orthographic knowledge. In the process of coding articles, 6 articles did not fit inclusion criteria by not explicitly measuring teachers' knowledge

(Carreker et al., 2007; Ehri & Flugman, 2018; Lyon & Weiser, 2009) or only covering phonological awareness (Fielding-Barnsley, 2010; McCutchen et al., 2002; Westerveld & Barton, 2017). The remaining 44 articles were coded for survey information, populations, and performance. Percent correct was either reported or calculated from information reported to only include BEEL unless otherwise noted. See Table 2.1, for a historical presentation and description of all survey research examined.

From those 44 studies, five psychometrically validated measures emerged. Two measures employed classical test theory (CTT; Binks-Cantrell, Joshi, & Washburn, 2012; Salinger et al., 2010) and three employed item response theory (IRT; Carlisle, Kelcey, Rowan, & Phelps, 2011; Folsom et al., 2017; Phelps & Schilling, 2004) as validation methods. The asterisk next to the year in Table 2.1 denotes the use of a psychometrically validated measure.

Since Moats' 1994 seminal paper on teachers' knowledge, 44 studies examining teachers' knowledge of BEEL as phonological awareness (phonological sensitivity and / or phonemic awareness) and phonics (decoding and / or encoding) with or without morphology were published. The sheer volume suggests a field already saturated. To further explore if a need for another survey exists, the top three most widely used measures (Binks-Cantrell, Joshi, & Washburn, 2012; Bos, Mather, Dickson, Podhajski, & Chard, 2001; Moats, 1994) and the three most recently developed measures (Carlisle et al., 2011; Cohen, Mather, Schneider, & White, 2017; Folsom et al., 2017) were tabulated by domain assessed. See Table 2.2 for the breakdown of items by knowledge and skill across the elements of the English language. The table presents the variability across surveys between domains assessed and number of items per domain. Equal item

distribution across domains is import for comparisons between domains of knowledge (Phelps & Schilling, 1994). Therefore, these results support the need for a measure with equal distribution of items across components of the English language.

Obstacles with measures

The current validated measures in use for examining teacher knowledge of BEEL present a few obstacles. First, the limited number of validated measures and the variation in validation methods may limit the usefulness of a measure (DeMars, 2010). In CTT, a person's true score is test dependent and item- and parameter- indices are sample dependent (Hambleton & van der Linden, 1982). The problem with a test dependent score is that different tests will have different true scores even if the test is to measure the same construct (Hambleton & van der Linden, 1982). In other words, CTT is more apt to provide a performance assessment of the test given, making it more difficult to obtain a measure of a person's true ability. Hambleton and van der Linden (1982) suggested it may take the administration of four measures to find true ability, which may not be reasonable in the field of teacher research. Additionally, if the norming sample of a CTT constructed survey demonstrated high ability, the survey may not differentiate between abilities of lower performing examinees. On the other hand, if the norming sample had lower abilities than the testing condition, the test may suffer from ceiling effects (Hambleton & van der Linden, 1982). This sample dependency may pose a problem if the measure was psychometrically developed with a sample of participants with too low or too high abilities. However, it should be noted that CTT item estimates and IRT item estimates demonstrated comparable correlations across different but similar samples (Fan, 1998 as cited in DeMars, 2010). CTT item estimates cover *p*-value and *r*-

correlation. The *p*-value indicates proportion correct, which is derived from the proportion of examinees answering the item correctly. The *p*-value should range from 0.25 to 0.95 with lower scores indicating a more difficult item for the sample examined. The *r* correlation represents an item's discriminating power and should range from 0.30 to 0.90. Sample dependent indices derived from CTT alone may limit the usefulness of a CTT constructed survey to accurately examine a population different from the validation sample.

IRT constructed measures provide the advantage of population invariance (DeMars, 2010). In other words, using IRT calibrated scoring to develop a measure removes the elements of sample and test dependency to provide a more precise estimation of ability (Hambleton & van der Linden, 1982). IRT overcomes CTT sample confounds by providing item- and person-parameter indices that are not sample- and test-dependent (Hambleton & van der Linden, 1982). IRT encompasses three parameter logistic models (PLM). The model name indicates the number of parameters estimated: 1PLM, 2PLM, and 3PLM. The 1PLM contains the *b*- parameter. The *b*- parameter indicates item difficulty with lower scores (< -1.0) indicating an easy item and higher scores (> 1.0) a more difficult item. The 2PLM contains *a*- and *b*- parameters. The *a*- parameter indicates the ability of the test item to discriminate between high and low ability examinees. A higher score indicates better discrimination, and a score lower than 0.4 contributes little measurement information. The 3PLM contains *a*-, *b*-, and *c*- parameters. The *c*- parameter indicates the probability of a low scoring participant guessing to obtain the correct answer. Hambleton and van der Linden (1982) recommend

IRT to achieve a "test-free person score" (p. 347). Additionally, IRT calibrated items allow for the assemblage of new forms derived from item functions (DeMars, 2010).

Measuring the impact of training on teacher knowledge acquisition is not without its difficulties even with IRT validated measures. One difficulty arises from test-retest effects, and multi-form measures strive to overcome test-retest effects (Gall, Gall, & Borg, 2006). Folsom et al. (2017) strived to overcome test-retest effects by employing IRT to develop two psychometrically equated forms. Their implementation of the validated measure demonstrated another struggle with measurement of teacher knowledge in response to training: the sensitivity of a measure to capture variations in ability across levels of training. In comparing degrees of training across administrations to those with no training, in-training teachers correctly answered approximately one additional item while completed training teachers answered approximately two additional items, a variation in knowledge reported to be "likely related to other factors" not attributed to progress in training (Folsom et al., 2017, p. A-10). Similarly, another difficulty in measuring teacher knowledge acquisition is the accuracy of discriminating between varying abilities. Carlisle et al. (2011) reported the IRT validated *Teachers' Knowledge of Reading and Reading Practices* "accurately assesses whether teachers know relatively little about the content" measured, which may make it difficult to reliably examine teachers who know more (p. 305). A goal of measuring teachers' knowledge acquisition in response to training is accurately assessing participants with little, medium, and high levels. Examining the differences in baseline knowledge and assimilation of knowledge through training calls for measures that can differentiate across a spectrum of abilities.

Purpose

Arguably, teacher knowledge of literacy constructs in and of itself is not the be-all, end-all to solving stagnant literacy levels. However, it is important to continue to improve teacher knowledge and skills especially in response to the National Governing Board Association (2018) implicating teachers' instructional practices, which research links with degree of content knowledge (Cohen et al., 2017; McCutchen & Berninger, 1999; Piasta, Conner, Fishman, & Morrison, 2009). This study strives to fill a void in the literature by providing a survey constructed with equal item distribution across domains of basic elements of English language validated with IRT. Additionally, given that an IRT multi-form comprehensive literacy measure exists (Folsom et al., 2017), it is proposed that an IRT constructed multi-form measure examining the fine grain knowledge of the science of English is warranted. Therefore, the purpose of this research was to validate items for a multi-form measure of *Basic Elements of English Language: A Test of Knowledge for Word Level Intervention* (*BEEL*) leveraging the power of IRT to provide a psychometrically validated instrument with equal distribution of items across the domains of phonological sensitivity, phonemic awareness, decoding, encoding, and morphology.

The following research questions guided the validation process:

- Does Form A have acceptable reliability indices according to CTT?
- Does Form B have acceptable reliability indices according to CTT?
- Does Form A have acceptable psychometric properties according to IRT analysis?
- Does Form B have acceptable psychometric properties according to IRT analysis?

Given that the future intent of the instrument is to examine knowledge growth in response to training, a second aspect of validation explored the ability of the instrument to differentiate between teachers with two-years of dyslexia therapy training and teachers with no dyslexia therapy training. A difficulty that Folsom et al. (2017) noted was that performance on the test combined with time in training did not demonstrate significant differences between those who finished training and those who had not started training. Therefore, it is important to examine the strength of the measure to predict differences between those who have two years of dyslexia therapy training from those who have no training. The following research question guided step 2 of the validation process:

- How accurate is the discriminant analysis function using IRT scoring in differentiating teachers who have two years of dyslexia therapy training and those who have none?

Method

Participants

Participants consisted of 388 certified teachers and dyslexia therapists recruited from several southern United States training centers located in states with dyslexia laws. Participants held either a bachelor's degree (n = 191) or master's degree (n = 197) and were predominately female (n = 364) elementary teachers (n = 249). See Table 2.3 for distribution of teaching experience by grade taught. Additionally, participants had varied length of dyslexia training from no training (n = 176) to two years of training (n = 119). The two-year dyslexia therapy training model provides trainees with instruction and clinical practice in phonological awareness including phonemic awareness, decoding and spelling (letter-sound relationships, syllable types, and syllable division patterns),

morphemes, vocabulary, text structure, comprehension, handwriting, and written expression. Trainees are instructed in direct, systematic, and cumulative methods. Acquiring this information and clinical practice occurs over two-years with 200 classroom instructional hours, 700 hours of clinical practice teaching at least 3 different situations of struggling readers, and 10 observations completed by a certified instructor who provides mentoring and coaching feedback.

Materials

Two 50 item multiple choice surveys were developed covering the basic elements of English language comprising of phonology (phonological sensitivity, phonemic awareness) and orthography (decoding, encoding, and morphology). Deconstructing phonology into phonological sensitivity and phonemic awareness will allow for a balance of items covering phoneme level and above the phoneme level (onset, rime, syllable) in lieu of examining phonological awareness. Deconstructing orthography into decoding, encoding, and morphology will allow more in-depth examination of these domains, which are typically examined as phonics and morphology. Ten questions were drafted for each domain based on research of previous measures (e.g. Moats, 1994; Binks-Cantrell et al., 2012) and that support standards from International Dyslexia Association's *Knowledge of the Structure of Language*, a subsection of *Knowledge and Practice Standards for Teachers of Reading* (Moats et al., 2010). The desire to align to these standards supports the intent of the measure to assess the fine grain nature of the science of English and to free the measure from program specific questions. See Figure 1 for a complete list of knowledge and skills assessed.

Each domain contained 5 knowledge and 5 skills questions resulting in 10 questions per domain of knowledge. For example, a question in phonemic awareness knowledge covered the definition of a phoneme: “The smallest speech sound that if changed changes the word is a/n”. Whereas a skills question examined phoneme identification: “Cognate phonemes are formed with the same mouth position but different voicing. What is the cognate to /b/ as in bat?” Similarly, a question in morpheme knowledge related to the definition of a morpheme: “A morpheme is”. Whereas a morpheme skills question required counting morphemes: “How many morphemes are in snowballs?” The rational for equal item distribution across domains was to allow for direct analysis among domains of knowledge (Phelps & Schilling, 2004). One hundred items were created for assembling two forms. Next, reading and literacy experts reviewed test items and provided feedback. Then a pilot test was conducted for clarification of questions and general comments.

Procedures

Training center personnel were briefed on administering the survey packet and served as proctors. Prior to administration, participants were provided the opportunity to voluntarily participate, consent, and create a unique identifier code. Printed surveys were administered in a classroom setting with randomization to Form A (n = 191) or Form B (n = 197) so that people sitting next to each other had different forms. Randomization resulted in relatively similar distribution by highest degree held and years of teaching experience (see Table 2.4). Testing was untimed with completion time less than 30 minutes. Completed surveys were entered into a spreadsheet then computer scored

resulting in a dichotomous answer (0 = incorrect, 1 = correct). Approximately 10% of the surveys were pulled and cross checked for errors in data entry.

Analysis and Result

The Basic Elements of English Language: A Test of Knowledge for Word Level Intervention is a multi-form measure designed to examine proficiency in core instructional components of word level intervention. Questions (items) provided four multiple choice answers that were dichotomously scored as incorrect (0) or correct (1) for analysis. IRT analysis was conducted to calibrate items and *Cronbach alpha* was used to examine reliability of each form.

An examination of dimensionality and local independence was conducted by performing exploratory factor analysis with promax rotation and graphing a scree plot of the eigenvalues. Analysis of factor loadings revealed Form A had 18 loadings on the first latent factor greater than .40 and Form B had 15. Guadagnoli and Veliver (1988) suggested that a factor is reliable if 10 or more loadings are greater than .40 for samples greater than 150. No other factors contained loadings greater than 10 on either form. For Form A, the first factor had an eigenvalue of 6.57 accounting for 17% of variance. The eigenvalues for factors two to four were 2.23, 1.90, and 1.77 respectively, together accounting for a further 15% of variance. For Form B, the first factor had an eigenvalue of 7.40 accounting for 15% of variance. The eigenvalues for factors two to four were 2.16, 2.09, and 1.91 respectively, together accounting for a further 13% of variance. An examination of the scree plot for both forms (see Figure 2.2 and 2.3) indicated a big drop between the first and second eigenvalues, but a small drop between the second and third eigenvalues and the third and fourth eigenvalues. These findings may suggest one

dominant factor and one to three minor factors. Binks et al. (2012) found six latent factors in their CTT measure validation study. However, Carlisle, Correnti, Phelps, and Zeng (2009) identified one factor, which was supported by the research of Folsem et al. (2017) despite the measures having several categories of questions. Given previous research findings, a noted dominate factor in the scree plot, and the number of factor loadings, one dominant factor emerged: basic elements of English language. Therefore, the assumption of unidimensionality and local independence was deemed reasonable.

IRT Calibration and CTT Reliability

To address research questions one to four, IRT item parameter estimation was conducted with *Xcalibre*, which provided both CTT reliability indices and IRT psychometric properties (Guyer & Thompson, 2012). All models were initially run to examine model fit. An examination of model fit for Form A suggested 2PLM was better than 1PLM ($\Delta\chi^2_{1\text{-}2}$ 91.519, $p < .05$) and 3PLM ($\Delta\chi^2_{2\text{-}3}$ -83.208, $p < .05$). An examination of model fit for Form B suggested 2PLM was better than 1PLM ($\Delta\chi^2_{1\text{-}2}$ 90.047, $p < .05$) and 3PLM ($\Delta\chi^2_{2\text{-}3}$ 15.989, $p < .05$). Therefore, test items were calibrated with the 2 PLM as it demonstrated the best model fit for the data.

Form A statistics. Form A *Cronbach's α* was 0.86. The *a*-parameter represents item discrimination; the higher the value, the better an item discriminates between higher and lower performing examinees. For the *a*-parameter ($M = 0.61$, $SD = 0.14$) items ranged from 0.32 to 0.87 with 39 items > 0.50. The *b*-parameter represents item difficulty (*b*) with lower values representing easier items and higher values indicating more difficult items. For the *b*-parameter ($M = -0.66$, $SD = 1.28$) items ranged from -3.02

to 2.089. Form A is a relatively easy test as the mean of the *b*-parameter was lower than 0.

Form A item calibration. Table 2.5 presents item parameter indices for calibrated items. Item 24 asked the definition of a derivational morpheme. It was the hardest item (*b*-parameter = 2.09) and had the lowest discrimination ability (*a*-parameter = 0.32). This suggests that knowing the definition of a derivational morpheme did not relate to an examinee's overall score. Item 39 (VCCV syllable division of a nonsense word) was the easiest (*b*-parameter = -3.02) yet demonstrated moderate discrimination ability (*a*-parameter = 0.77). According to IRT parameter indices, items 19, 24, and 45 have very low discrimination ability (*a*-parameter < 0.40). This suggests these items contribute less than other items and could be eliminated.

Form B statistics. Form B *Cronbach's α* was 0.87. For the *a*-parameter (*M* = 0.68, *SD* = 0.16) items ranged from 0.33 to 1.12 with 45 items > 0.50. For the *b*-parameter (*M* = -0.93, *SD* = 1.00) items ranged from -2.57 to 1.97. Form B is a very easy test as the mean of the *b*-parameter was lower than 0.

Form B item calibration. Table 2.6 presents item parameter indices for calibrated items. Item 18 (doubling rule) was the hardest item (*b*-parameter = 1.97) and had the lowest discrimination ability (*a*-parameter = 0.33). While knowing the doubling rule is important to spelling instruction, the wording of the question appears to make the question more difficult to answer than the matched question 18 on Form A that had a *b*-parameter of 1.34 and an *a*-parameter of 0.53. Item 37 (soft c) was the easiest item (*b*-parameter = -2.57) yet demonstrated acceptable discrimination ability (*a*-parameter =

0.64) according to IRT calibration. Since item 18 has very low a-parameter value from IRT, it should be eliminated or substituted with Form A item 18.

Prediction of Group Membership

Discriminate analysis (DA) and binary logistic regression (BLR) are two ways to predict group membership. Therefore, both analyses were conducted to examine the potential of demonstrated proficiency on the measure to distinguish between those with two years of dyslexia therapy training and those with no training. Calibrated items were used to obtain theta scores (demonstrated proficiency) for each participant, which were then used to predict group membership.

For BLR model, the omnibus test of model coefficients was significant, $\chi^2(1) = 132.83$, $p < .001$. The model accounted for 78.6% of cases being classified correctly with 88.6% of the No Training group and 63.4% of the 2 Years Training group classified correctly. For the DA, the use of theta scores as the sole predictor for group membership significantly differentiated between groups, $\Lambda = 0.62$, $\chi^2(1) = 140.59$, $p < .001$. The model accounted for 79.0% of cases being classified correctly overall with 89.2% of the No Training group and 63.9% of the 2 Years Training group classified correctly. Since both BLR and DA were similar, we moved forward using the DA, which reported prior probabilities for groups. To evaluate the classification accuracy overall, we first calculated the proportional chance criterion. Teachers with no training ($n = 176$) comprised 59.7% of the sample and teachers with two years of training ($n = 119$) comprised the remaining 40.3%. This resulted in a 51.8% proportional chance criterion ($.597^2 + .403^2 = .518$). Since maximum chance criterion (59.7%) is larger than chance criterion (51.8%), we used the maximum chance criterion for the t-test. Overall classification accuracy of

79.0% (hit ratio) is substantially higher than maximum chance criterion (59.7%), t(295) = 11.39, $p < .01$. Therefore, we determined the classification accuracy to be acceptable.

Because group membership is easily obtained from background information regarding training, the purpose of predicting groups was not to build a model but to examine if demonstrated proficiency on the measure could reliably differentiate between groups. To further explore if demonstrated proficiency on the measure was sensitive enough to distinguish differences between these training conditions, we conducted a t-test with the theta scores calculated from the calibrated measure. On average, teachers with no training (M = -0.50, SD = 0.65) demonstrated less knowledge than those with two years of training (M = 0.67, SD = 0.85). This difference, -1.17, 95% CI [-1.35, -0.99], was significant $t(207.58) = -12.78$, $p < .001$, and represented a large-sized effect, d = 1.55. Therefore, we determined that the calibrated measure could reliably examine differences between training conditions.

Discussion and Conclusion

As states begin to unravel the educational implications of laws governing identification of students with dyslexia and training requirements of teachers who teach them, it is important to experimentally examine the differences in models of such training. Two 50 item measures of the fine grain knowledge of the structure of English were psychometrically validated and on average could differentiate between teachers with no dyslexia therapy training and teachers with two years of dyslexia therapy training. This suggests that the measure could be used to examine if there are differences in knowledge of BEEL among training models and potentially be used to examine growth

in knowledge in a longitudinal study following an A (before training) – B (mid training) – A (completed training) format.

Some of the test items recommended for elimination suggest there is no benefit to possessing fine grain knowledge and overall proficiency of BEEL. For example, knowing the definition of a deviational (A24) and inflectional morpheme (B24) was not predictive of high performance. This suggests that possessing this knowledge may not be as beneficial as demonstrating this knowledge in instructional practices that address adding morphemes to words for spelling (derivational) or how some morphemes change the part of speech of a word (inflectional). While eliminating these definitions may seem logical, it might be useful to retain them to compare knowledge to observed instructional practices.

We propose that the use of the validated measure to examine teacher knowledge is just part of an overall equation in exploring teacher efficacy (Arrow, 2019; Ehri & Flugman, 2018). When teacher knowledge is compared with observations of teaching, Phelps, Johnson, and Carlisle (2009) suggested that high and low knowledge teachers differed in instructional practices with higher knowledge teachers providing higher quality instruction. Piasta et al. (2009) also noted that higher knowledge teachers' decoding instructional practices significantly predicted their students' word identification. Ehri and Flugman (2018) opted for observed knowledge as demonstrated through instructional practice. Therefore, teacher knowledge assessment in and of itself may not be as informative as once deemed when examining teacher effectiveness in conjunction with student reading outcomes. This suggests that combining knowledge assessment with observations of instructional practices may be an essential component in

examining the impact of a teacher's knowledge on instruction and student word level reading outcomes. Therefore, we propose that the measure be used in conjunction with other forms designed to help quantify teacher observations (e.g., Ehri & Flugman, 2018).

The Basic Elements of English Language: A Test of Knowledge for Word Level Intervention is limited to assess the fine grain knowledge of the structure of English language and not an overall assessment of a teachers' knowledge of the science of reading. Even though the measure was validated with certified teachers who were primarily elementary teachers, some test items may not be as meaningful in examining early education teachers as they are in examining knowledge of teachers participating in dyslexia therapy training. For example, teachers in K – 1 would not need to know how to count morphemes in multisyllabic words of Latin or Greek origin (A47, A50, B47, B48, B50) to effectively deliver code instruction to early readers, but the items do provide insight into the depth of knowledge of the elements of English. In real world settings, teachers may find themselves in first grade one year and fifth grade the following year, which suggests the importance of a broad range of knowledge.

For the sake of children with characteristics of dyslexia and the future trajectory of their life, it appears important to know if there are differences in teacher knowledge among the different types of licensing and / or training requirements designated by state laws concerning teachers who work with students with characteristics of dyslexia. Additionally, it is important to know if the possession of this knowledge impacts a teacher's observed instructional practices and the word reading growth of their students with characteristics of dyslexia. While there are viable intervention programs for teaching struggling readers and those students with characteristics of dyslexia, a reading program

does not replace the importance of a highly knowledge teacher. Cohen et al. (2017) suggested:

> The use of scripted programs without high levels of knowledge can lead to inappropriate teaching methods, undermining the purpose of scripted instruction (Moats & Foorman, 2003). Furthermore, scripted programs often do not address how to tailor instruction based on individual needs and abilities, nor do they typically allow teachers to adjust the speed at which an individual should progress, nor determine when to introduce supplementary materials. Effective individualized instruction requires the expertise of a highly trained teacher. (p. 679)

We believe this measure can be used to examine if dyslexia therapy training produces teachers with a high degree of code knowledge that students with characteristics of dyslexia deserve.

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Table 2.1 *Historical presentation of basic elements of English language (BEEL) surveys*

Year	Reference	Survey description	Survey type	Participants	Percent Correct
1994	Moats (1994)	*Informal Survey of Linguistic Knowledge* is a 15 question 54 item assessment using underlining, fill in the blank, or open ended format	BEEL	*n* = 89 IST	28.5
1996	Moats & Lyon (1996)	*Informal Survey of Linguistic Knowledge* (Moats, 1994)	BEEL	*n* = 103 educators	not reported
1999	McCutchen & Berninger (1999)	*Informal Survey of Linguistic Knowledge* (Moats, 1994)	BEEL	*n* = 59 IST K (*n* = 24) 1st - 2nd (*n* = 27) SPED (*n* = 8)	33.17 30.70 33.00 35.80
2001	Bos, Mather, Dickson, Podhajski, & Chard, (2001)	*Knowledge Assessment for Preservice and In-service Educators*, a 20 item multiple choice test adapted from Lerner (1997), Moats (1994), and Rath (1994) and relatively similar to Mather et al. (2001).	BEEL + Beliefs	*n* = 252 PST *n* = 286 IST	53.00 60.05
2001	Mather, Bos, & Babur (2001)	*Teacher Knowledge Assessment: Structure of Language*, a 22 item multiple choice assessment with items adapted from Lerner (1997), Moats (1994), and Rath (1994) and relatively similar to Bos et al. (2001).	BEEL + Beliefs	*n* = 293 PST *n* = 131 IST	50.91 65.91

* Validated instrument, IST = In Service Teachers, PST = Preservice Teachers, SO = Student Outcomes
C = Comprehension, F = Fluency, G = Grammar, OL = Oral Language, RC = Reading Comprehension, V = Vocabulary, W = Writing

Table 2.1 continued

Year	Reference	Survey description	Measures	Participants	Percent Correct
2002	McCutchen, Abbott, Green, Beretvas, Cox, Potter, & Gray (2002)	*Informal Survey of Linguistic Knowledge* (Moats 1994)	BEEL + General World Knowledge	*n* = 24 treatment *n* = 20 control	53.60 46.60
2003	Moats & Foorman (2003)	*Teacher Knowledge Survey, Form #1* open ended format with scores not reported*, #2* multiple choice*,* and *#3* multiple choice (a series of measures to develop the TKS)	BEEL	Form 1 *n* = 50 K-2nd Form 2 *n* = 41 2nd-3rd Form 3 *n* = 103 3rd-4th	not reported 72 75.8
2003	Spear-Swerling & Buckner (2003)	*Test of Word Structure Knowledge* A/B forms each with 50 items covering graphophonemic segmentation (16 items), syllable identification of pseudowords (14 items), and determining regular and irregular words (20 items). Randomization to form A or B at pre and post testing. IG: instructional group indicates which class type the PST were in (day or evening).	BEEL	SPED PST: *n* = 17 IG day *n* = 31 IG evening *n* = 29 control	 72.47 53.81 34.48

* Validated instrument, IST = In Service Teachers, PST = Preservice Teachers, SO = Student Outcomes
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Table 2.1 continued

Year	Reference	Survey description	Measures	Participants	Percent Correct
2004	Cunningham, Perry, Stanovich, & Stanovich (2004)	*Phonological Awareness Knowledge* consisted of 11 items assessing phoneme counting. *Phonics Knowledge* consisted of 18 items grouped as explicit phonics (7 items) knowledge and implicit phonics (11 items) consisted of classifying words as regular or irregular	BEEL + Children's Literature + Perceived Knowledge	*n* = 722 IST K – 3rd	44.22
2004*	Phelps & Schilling (2004)	*Content Knowledge for Teaching Reading* is 77 items covering word analysis (35 items) and comprehension (42 items) validated with factor analysis, CTT, and IRT.	BEEL	*n* = 599 IST	validation study
2004	Spear-Swerling & Brucker (2004)	*Test of Word Structure Knowledge* see Spear-Swerling and Buckner (2003) for full description. SPED PST: Novice teachers in special education (SPED) certification program. IG+T: instructional group plus tutored students. IG: instructional group no tutoring.	BEEL + SO	SPED PST: *n* = 39 IG+T day *n* = 49 IG evening *n* = 59 comparison	 69.19 58.56 34.29
2005	Al Otaiba (2005)	*Teacher Knowledge Assessment: Structure of Language* see Mather, Bos, & Babur (2001) for full description. FI: fidelity of implementation measure journals: service learning reflections	BEEL + FI + journals + SO	*n* = 8 PST	99.38

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Table 2.1 continued

Year	Reference	Survey description	Type	Participants	Percent Correct
2005	Fielding-Barnsley & Purdie (2005)	*Survey of Linguistic Knowledge* (Moats, 1994) adapted to include 10 multiple choice questions. *Teacher attitudes about early reading and spelling* (Bos et al., 1999).	BEEL + Beliefs	*n* = 340 PST/IST PST (*n* = 93) IST (*n* = 209) SPED (*n* = 38)	61.20 unable to compute subgroups
2005	Spear-Swerling, Brucker, & Alfano (2005)	*Test of Word Structure Knowledge* (Spear-Swerling & Buckner, 2003) expanded with 12 morpheme counting items A /B and 5 general knowledge open ended questions. GS/IST graduate students primarily credentialed teachers (*n* = 119) from graduate programs in Elementary Education (*n* = 13), SPED (*n* = 42), and Reading (*n* = 73) divided into levels of background ability (HB - high, MB = medium, LB = low), a composite of preparation and experience.	BEEL + Perceived Knowledge	*n* = 132 GS/IST HB (*n* = 34) MB (*n* = 56) LB (*n* = 42)	50.95 59.10 50.30 43.46
2006	Meehan & Hammond (2006)	*Teacher Knowledge of Language Structure* 10 multiple choice items adapted from Moats (1994) and Fielding-Barnsley, & Purdie (2005). *Teacher Perceptions Toward Early Reading and Spelling* adapted from Mather, Bos, & Babur (2001).	BEEL + Perception	*n* = 43 PST	50.00

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Table 2.1 continued

Year	Reference	Survey description	Type	Participants	Percent Correct
2007	Al Otaiba & Lake (2007)	*Teacher Knowledge Assessment: Structure of Language* see Mather, Bos, & Babur (2001) for full description.	BEEL + Preparedness + Journals + SO	*n* = 18 PST	87.36
2008	Maher & Richdale (2008)	*Linguistic Knowledge Assessment* a 10 item multiple choice questionnaire adapted from Moats (1994).	BEEL + Preparedness + Perception	*n* = 120 IST	46.20
2009	Carlisle, Correnti, Phelps, & Zeng (2009)	*Language and Reading Concepts* 56 items administered in three parts (A 20 items, B 20 items, and C 16 items) across training aligned to LETRS modules 2 - 7.	BEEL + C, G, W + Reading Concepts + SO	*n* = 747 IST 1^{st} – 3^{rd}	not reported
2009	Brady, Gillis, Smith, Lavalette, Liss-Bronstein, Lowe et al. (2009)	*Teacher Knowledge Survey* a 74 item instrument of which this study used 60 items (20 phonemic awareness, 20 code concepts, 6 fluency, and 14 vocabulary and oral language).	BEEL + F, V, OL + Attitude	*n* = 65 IST	75.05
2009	Joshi, Binks, Hougen, Dahlgren, Ocker-Dean, & Smith (2009)	*Survey of Language Constructs Related to Literacy Acquisition* 68 items based on previous research (McCutchen et al., 2002; Moats, 1994).	BEEL + Supplementary Knowledge	*n* = 78 university instructors of reading	56.83

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Table 2.1 continued

Year	Reference	Survey description	Type	Participants	Percent Correct
2009	McCutchen, Green, Abbott, & Sanders (2009)	*Informal Survey of Linguistic Knowledge* (Moats 1994) with pre-post administration. Post administration percent correct reported.	BEEL + SO	*n* = 37 3rd - 5th *n* = 16 treatment n = 14 control	61.80 not reported
2009*	Phelps (2009)	*Content Knowledge for Teaching Reading* a 119 item survey covering pedagogical and content knowledge of word analysis (35 items) and comprehension knowledge of content and teaching (84 items). Employed 1PL IRT.	BEEL + RC + Knowledge and Teaching Practices	*n* = 50 IST *n* = 55 Non Teacher	70.33 63.90
2009	Piasta, Connor, Fishman, & Morrison (2009)	*Teacher Knowledge Assessment: Language and Print* a survey covering phonology, orthography, morphology and literacy acquisition and instruction	BEEL + Literacy Acquisition and Instruction + SO	*n* = 42 IST 1st grade *n* = 19 treatment *n* = 23 control	52.00
2009	Podhajski, Mather, Nathan, & Sammons (2009)	*The Survey of Teacher Knowledge* is a 32 item multiple choice assessment adapted from Lerner (1997) Moats (1994), and Rath (1994)	BEEL + SO	*n* = 4 IST 1st-2nd	81.00
2009	Spear-Swerling (2009)	*Test of Word Structure Knowledge* A/B forms (Spear-Swerling & Buckner, 2003) plus morpheme counting and general knowledge about reading (Spear-Swerling, Buckner, & Alfano, 2005)	BEEL + SO	*n* = 45 PSTs 3 cohorts	65.92

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C = Comprehension, F = Fluency, G = Grammar, OL = Oral Language, RC = Reading Comprehension, V = Vocabulary, W = Writing

Table 2.1 continued

Year	Reference	Survey description	Type	Participants	Percent Correct
2010*	Salinger, Mueller, Song, Jin, Zmach, Toplitz, et al. (2010)	*The Pre-service Teacher Knowledge Assessment*, a 53 item assessment. Alphabetics subscale, 18 items, included phonemic awareness (11) and phonics (7). Validation employed CTT with 142 preservice teachers. RR = Reading Researcher; RTE = Reading Teacher Educator; N = Adult not a teacher or researcher	BEEL + F, V, C + preparedness	*n* = 142 PST-validation *n* = 2187 PST *n* = 15 RR *n* = 19 RTE *n* = 28 N	61.05 52.96 84.80 75.70 47.80
2011*	Carlisle, Kelcey, Rowan, & Phelps (2011)	*Teachers' Knowledge of Reading and Reading Practices*, a psychometrically validated measure using EFA and one parameter IRT.	BEEL + RC Knowledge and Teaching Practices + SO	*n* = 864 IST	not reported
2011	Washburn, Joshi, & Binks-Cantrell (2011a)	28 questions with 62 items from the *Teacher Knowledge of Basic Language Concepts*	BEEL + Perception	*n* = 91 PST	63.14
2011	Washburn, Joshi, & Binks-Cantrell (2011b)	*Teacher Knowledge of Basic Language Concepts* and *Teacher Knowledge of Dyslexia*	BEEL + Dyslexia Knowledge	*n* = 185 K-5 IST	64.75
2012	Al Otaiba, Lake, Greulich, Folsom, & Guidry (2012)	*Teacher Knowledge Assessment: Structure of Language* (Mather et al., 2001), 22 multiple choice items assessing knowledge and a *Preparedness to Teach Reading Survey* (Al Otaiba & Lake, 2007)	BEEL + Preparedness + logs + SO	*n* = 28 PST TAILS (*n* = 14) Book Buddies (*n* = 14)	68.63 70.91 66.36

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C = Comprehension, F = Fluency, G = Grammar, OL = Oral Language, RC = Reading Comprehension, V = Vocabulary, W = Writing

Table 2.1 continued

Year	Reference	Survey description	Type	Participants	Percent Correct
2012*	Binks-Cantrell, Joshi, & Washburn (2012)	*Basic Language Constructs Survey* a 38 item knowledge survey plus 8 perception items based on Joshi et al.'s (2009) 52 item pilot study. The survey was validated with EFA and CTT.	BEEL + Perception	*n* = 114 TE *n* = 172 PST	validation study, not reported
2012*	Binks-Cantrell, Washburn, Joshi, & Hougen (2012)	*Basic Language Constructs Survey* see Binks-Cantrell, Joshi, & Washburn (2012).	BEEL + Perception	*n* = 48 TE-PD *n* = 66 TE-NPD *n* = 55 TC-PD *n* = 118 TC-NPD	77.07 57.92 64.48 48.00
2012	Spear-Swerling, & Cheesman (2012)	*Teacher Knowledge Survey* a 66-item multiple choice test modeled after a teacher licensure exam assessing phonemic awareness and phonics (17 items), fluency, vocabulary, and comprehension (24 items), and Response to Intervention (RTI, 25 items).	BEEL + RTI + F, V, C	*n* = 142 IST *n* = 77 Code *n* = 65 No Code Code indicates OG training	60.80 71.75 54.85
2013	Leader-Janssen & Rankin-Erickson (2013)	*Content Knowledge for Teaching Reading* (Phelps and Schilling, 2004) and the *Informal Survey of Linguistic Knowledge* (Moats, 1994) were used to measure knowledge.	BEEL + Perception + Semi structured interviews	*n* = 33 PST *n* = 21 treatment *n* = 13 control	86.12 56.16

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C = Comprehension, F = Fluency, G = Grammar, OL = Oral Language, RC = Reading Comprehension, V = Vocabulary, W = Writing

Table 2.1 continued

Year	Reference	Survey description	Type	Participants	Percent Correct
2013	Spear-Swerling & Zibulsky (2013)	*Teacher Knowledge Survey* (Spear-Swerling & Cheeseman, 2012) subscales of phonemic awareness and phonics (20 items), fluency, vocabulary, and comprehension (18 items). *Literacy arts activity grid* (LAAG) (Cunningham et al., 2009).	BEEL + F, V, C + LAAG	*n* = 102 IST K-5 & SPED	55.00
2014	Tetley & Jones (2014)	An 11 item knowledge of language constructs survey derived from Field-Barnsley and Purdue (2005) and Joshi et al. (2009).	BEEL + Perception	*n* = 224 PST *n* = 150 2nd year *n* = 74 3rd year	70.45 74.90 66.00
2016	Stark, Snow, Eadie, & Goldfeld (2016)	A 56 item survey of teacher knowledge of basic language concepts with 43 items derived from previous research (Binks-Cantrell et al., 2012; Fielding-Barnsley & Purdie, 2005; Washburn et al. 2011) and 13 items assessing discourse level knowledge.	BEEL + Discourse Knowledge + Perception and Beliefs	*n* = 78 IST	55.00
2016*	Washburn, Binks-Cantrell, Joshi, Martin-Chang, & Arrow (2016)	*Survey of Basic Language Constructs* see Binks-Cantrell, Joshi, & Washburn (2012).	BEEL + Perception	*n* = 278 PST CAN (*n* = 80) ENG (*n* = 55) NZ (*n* = 26) USA (*n* = 118)	56.00 67.00 49.00 56.00 50.00

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C = Comprehension, F = Fluency, G = Grammar, OL = Oral Language, RC = Reading Comprehension, V = Vocabulary, W = Writing

Table 2.1 continued

Year	Reference	Survey description	Type	Participants	Percent Correct
2017	Clark, Helfrich, & Hatch (2017)	*Literacy Information Knowledge Scale Written Survey* (Reutzel et al., 2007) a 75 item measure of content knowledge and pedagogical knowledge	BEEL + C + Pedagogical Knowledge	*n* = 87 PST	67.93
2017	Cohen, Mather, Schneider, & White (2017)	*The Survey of Preparedness and Knowledge of Language Structure Related to Teaching Reading to Struggling Readers*, a novel survey of 42 items based on previous research (Bos et al., 1999, 2001; Mather et al., 2001; Moats, 1994; Moats & Foorman, 2003; Moats & Lyon 1996; Podhajski et al., 2009; Washburn et al., 2010, 2011). CBRP = Code Based Reading Program NCBRP = Non Code Based Reading Program	BEEL + Perceived Knowledge + SO	*n* = 114 K-3 IST CBRP (*n* = 60) *Fundations* NCBRP (*n* = 54)	67.24 65.95 67.45
2017*	Folsom, Smith, Burk, & Oakley (2017)	*Teacher Knowledge of Early Literacy Skills* a two parameter IRT validated multi-form measure (form A and B) comprised of 8 common items, 23 unique items per form equaling 31 items per form. Norming sample was 2,421 K-3 educators	BEEL + F, V, RC, G, W	*n* = 12,084 educators	51.24 mean of all domains

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Table 2.1 continued

Year	Reference	Survey description	Type	Participants	Percent Correct
2018*	Chapman, Greaney, Arrow, & Tunmer (2018)	*Survey of Basic Language Constructs* see Binks-Cantrell, Joshi, & Washburn (2012).	BEEL + Perception + Word ID error	*n* = 55 IST Years 1 - 3 (K – 2nd)	66.50
2019	McMahan, Oslund, & Odegard (2019)	*Basic English Language Knowledge* A 50 item multi-form assessment of basic English language knowledge NT = No Training; Year 1 = completion of 1 year of dyslexia specific instruction; Year 2 = completion of 2 years of dyslexia specific instruction; Year2-C = completion of 2 years and certified as Certified Academic Language Therapists	BEEL	*n* = 347 NT (*n* = 176) Year 1 (*n* = 76) Year 2 (*n* = 52) Year 2-C (*n* = 43)	65.20 56.80 63.40 68.20 80.80

* Validated instrument, IST = In Service Teachers, PST = Preservice Teachers, SO = Student Outcomes
C = Comprehension, F = Fluency, G = Grammar, OL = Oral Language, RC = Reading Comprehension, V = Vocabulary, W = Writing

Table 2.2 *Distribution of items across select surveys measuring basic elements of English language (BEEL)*

	Knowledge						Skill					
	PS	PA	DE	EN	MO	Other	PS	PA	DE	EN	MO	Other
Binks-Cantrell et al. 2012[a]	1	3	5	2	1	0	7	10	2	0	1	1
Bos et al. 2001	2	3	4	0	0	0	0	8	3	0	0	0
Carlisle et al. 2011[b]	0	0	0	0	0	0	2	1	3	3	1	3
Cohen et al. 2017	2	3	9	0	2	0	6	8	8	0	6	0
Folsom et al. 2017[b]	1	1	3	2	0	1	1	1	6	3	3	9
Moats 1994	0	0	2	2	0	1	8	13	18	3	12	0
Proposed	5	5	5	5	5	0	5	5	5	5	5	0

[a] CTT validated measure, [b] IRT validated measures
PS = Phonological Sensitivity, PA = Phonemic Awareness, DE = Decoding, EN = Encoding, MO = Morphologic

Table 2.3 *Years of teaching experience by grade*

	ES	MS	HS	K – 12	Unknown
0 – 5 years	40	10	1	13	5
6 – 10 years	47	4	5	9	1
11 – 15 years	44	12	2	10	3
16 – 20 years	43	4	1	7	1
> 20 years	73	11	2	20	7
Unknown	2	0	0	5	6
Total	249	41	11	64	23

Table 2.4 *Characteristics by form*

	Form A	Form B
Teaching experience		
0 – 5 years	30	39
6 – 10 years	34	32
11 – 15 years	32	39
16 – 20 years	29	27
> 20 years	57	56
Unknown	9	4
Highest degree held		
Bachelor's	97	94
Master's	94	103

Table 2.5 *Form A item parameters*

	CTT Indices		IRT Indices			
Item #	P	S-Rpbis	*a*	*b*	*a* SE	*b* SE
1	0.51	0.31	0.41	-0.08	0.26	0.22
2	0.70	0.41	0.64	-0.98	0.16	0.16
3	0.70	0.32	0.57	-1.09	0.16	0.17
4	0.72	0.24	0.48	-1.32	0.16	0.21
5	0.24	0.38	0.62	1.34	0.13	0.18
6	0.74	0.22	0.48	-1.49	0.15	0.21
7	0.80	0.24	0.55	-1.70	0.14	0.20
8	0.79	0.28	0.60	-1.54	0.14	0.18
9	0.78	0.29	0.60	-1.51	0.14	0.18
10	0.60	0.25	0.47	-0.59	0.22	0.20
11	0.58	0.34	0.57	-0.44	0.20	0.16
12	0.59	0.45	0.73	-0.42	0.18	0.13
13	0.51	0.37	0.57	-0.08	0.21	0.16
14	0.77	0.43	0.87	-1.18	0.14	0.13
15	0.60	0.40	0.68	-0.50	0.18	0.14
16	0.79	0.29	0.63	-1.52	0.14	0.18
17	0.83	0.29	0.66	-1.71	0.13	0.18
18	0.26	0.30	0.53	1.34	0.14	0.20
19	0.33	0.03	0.34	1.28	0.19	0.28
20	0.28	0.38	0.59	1.12	0.14	0.18
21	0.65	0.33	0.59	-0.80	0.18	0.16
22	0.29	0.30	0.52	1.12	0.15	0.19
23	0.36	0.21	0.44	0.85	0.18	0.21
24	0.25	-0.05	0.32	2.09	0.15	0.31
25	0.73	0.27	0.57	-1.25	0.15	0.18
26	0.61	0.23	0.47	-0.68	0.21	0.19
27	0.86	0.01	0.42	-2.67	0.12	0.29
28	0.92	0.28	0.79	-2.28	0.12	0.21
29	0.95	0.20	0.77	-2.74	0.13	0.27
30	0.76	0.09	0.42	-1.75	0.15	0.24
31	0.64	0.50	0.87	-0.62	0.17	0.12
32	0.80	0.37	0.76	-1.41	0.14	0.15
33	0.71	0.45	0.82	-0.92	0.16	0.13
34	0.83	0.30	0.68	-1.71	0.13	0.18

Table 2.5 *continued*

	CTT Indices		IRT Indices			
Item #	P	S-Rpbis	*a*	*b*	*a* SE	*b* SE
35	0.25	0.52	0.83	1.06	0.13	0.14
36	0.79	0.29	0.61	-1.56	0.14	0.18
37	0.85	0.15	0.53	-2.21	0.12	0.24
38	0.86	0.29	0.72	-1.87	0.13	0.18
39	0.97	0.16	0.77	-3.02	0.13	0.32
40	0.81	0.35	0.77	-1.46	0.13	0.15
41	0.79	0.40	0.81	-1.31	0.14	0.14
42	0.95	0.16	0.71	-2.79	0.12	0.28
43	0.35	0.42	0.65	0.68	0.16	0.15
44	0.35	0.34	0.54	0.75	0.17	0.18
45	0.56	0.12	0.38	-0.39	0.26	0.23
46	0.41	0.42	0.63	0.36	0.18	0.15
47	0.26	0.35	0.60	1.24	0.14	0.18
48	0.39	0.43	0.66	0.44	0.17	0.15
49	0.35	0.39	0.62	0.71	0.16	0.16
50	0.38	0.46	0.70	0.47	0.16	0.14

Table 2.6 *Form B item parameters*

	CTT Indices		IRT Indices			
Item #	P	S-Rpbis	*a*	*b*	*a* SE	*b* SE
1	0.93	0.31	1.12	-1.95	0.13	0.17
2	0.78	0.31	0.72	-1.34	0.14	0.15
3	0.53	0.38	0.66	-0.21	0.19	0.14
4	0.74	0.31	0.61	-1.22	0.15	0.17
5	0.57	0.04	0.33	-0.54	0.27	0.26
6	0.86	0.33	0.77	-1.76	0.13	0.17
7	0.80	0.30	0.64	-1.54	0.13	0.17
8	0.74	0.24	0.53	-1.37	0.15	0.19
9	0.69	0.35	0.63	-0.93	0.16	0.15
10	0.78	0.17	0.49	-1.73	0.14	0.21
11	0.64	0.46	0.78	-0.63	0.17	0.13
12	0.61	0.41	0.69	-0.53	0.18	0.14
13	0.37	0.29	0.53	0.68	0.17	0.18
14	0.67	0.37	0.66	-0.80	0.17	0.15
15	0.77	0.44	0.89	-1.15	0.14	0.13
16	0.77	0.35	0.69	-1.29	0.14	0.15
17	0.93	0.35	0.99	-2.11	0.13	0.19
18	0.25	-0.06	0.33	1.97	0.15	0.30
19	0.71	0.41	0.72	-0.95	0.16	0.14
20	0.80	0.43	0.89	-1.30	0.14	0.13
21	0.64	0.49	0.86	-0.61	0.16	0.12
22	0.50	0.30	0.53	-0.06	0.21	0.17
23	0.43	0.31	0.54	0.34	0.19	0.17
24	0.32	0.18	0.43	1.10	0.17	0.22
25	0.63	0.39	0.70	-0.64	0.17	0.14
26	0.90	0.21	0.65	-2.36	0.12	0.23
27	0.72	0.31	0.58	-1.17	0.15	0.17
28	0.93	0.33	0.93	-2.13	0.13	0.19
29	0.92	0.21	0.74	-2.40	0.12	0.22
30	0.91	0.29	0.79	-2.13	0.12	0.19
31	0.72	0.29	0.57	-1.15	0.16	0.17
32	0.83	0.34	0.72	-1.66	0.13	0.17
33	0.26	0.44	0.77	1.02	0.13	0.14
34	0.90	0.35	0.92	-1.87	0.13	0.16

Table 2.6 *continued*

	CTT Indices		IRT Indices			
Item #	P	S-Rpbis	*a*	*b*	*a* SE	*b* SE
35	0.72	0.42	0.78	-0.96	0.15	0.13
36	0.64	0.28	0.55	-0.79	0.18	0.17
37	0.92	0.15	0.64	-2.57	0.12	0.25
38	0.76	0.46	0.87	-1.09	0.14	0.13
39	0.85	0.16	0.55	-2.09	0.12	0.22
40	0.84	0.34	0.72	-1.69	0.13	0.17
41	0.61	0.37	0.64	-0.58	0.18	0.15
42	0.77	0.29	0.63	-1.41	0.14	0.17
43	0.81	0.36	0.77	-1.47	0.13	0.15
44	0.34	0.31	0.51	0.85	0.17	0.19
45	0.81	0.28	0.63	-1.66	0.13	0.18
46	0.50	0.55	0.92	-0.09	0.16	0.11
47	0.35	0.27	0.49	0.81	0.17	0.19
48	0.60	0.44	0.74	-0.49	0.17	0.13
49	0.54	0.38	0.61	-0.25	0.19	0.15
50	0.63	0.27	0.55	-0.71	0.19	0.17

BEEL Components Examined	
Knowledge	Skill
Phonological Sensitivity	
• phonological awareness • rhyme detection • rhyme generation • onset • rime • syllable blending • syllable deletion	• onset identification • rime identification • syllable counting real words • syllable counting nonsense words
Phonemic Awareness	
• phoneme • phonemic awareness • phoneme isolation • phoneme segmentation • phoneme transposition	• consonant sound descriptions • consonant sound similarities • cognate identification • phoneme counting
Phonics - Decoding	
• grapheme • analytic phonics • synthetic phonics • digraph • diphthong • consonant blend • syllable types	• grapheme – phoneme identification • mapping graphemes to phonemes • decoding nonsense words • syllable type identification real words • syllable type identification nonsense words • applying syllable types to vowel sounds • syllable division of nonsense words
Phonics - Encoding	
• spelling /k/ • floss rule • doubling rule • dropping rule • changing rule	• spelling nonsense words • spelling derivative with nonsense base word • spelling situations for vowel sounds
Morphology	
• characteristics of Anglo-Saxon, Greek, Latin, and French words • morpheme • derivational morpheme • inflectional morpheme	• morpheme counting: Anglo-Saxon • morpheme counting: Latin • morpheme counting: Greek

Figure 2.1 *Knowledge and skills examined by domain*

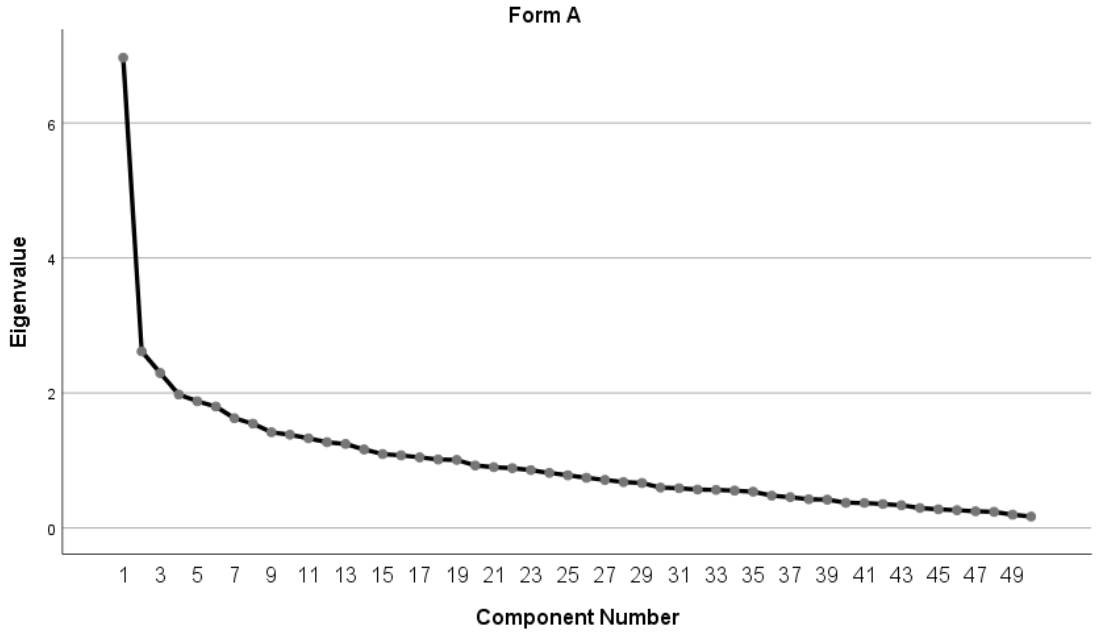

Figure 2.2 *Scree plot of eigenvalues for form A*

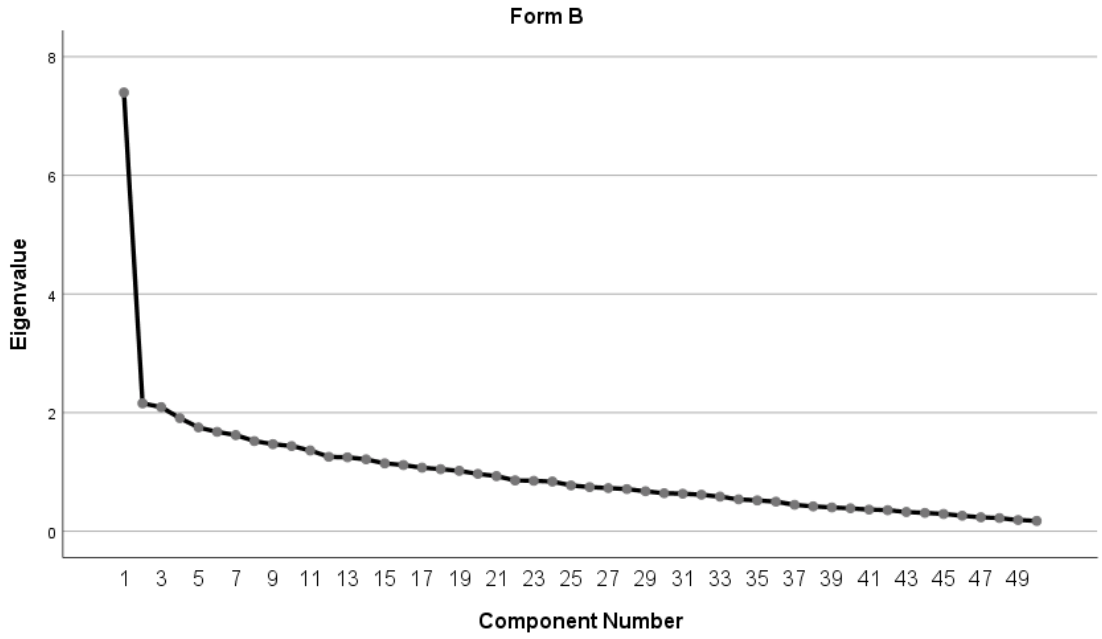

Figure 2.3 *Scree plot of eigenvalues for form B*

APPENDIX I

SURVEY A

1. An onset is:

   a. the initial letter of a word

   b. the initial consonant of a word

   c. the initial consonant(s) before the first vowel

   d. the initial consonant(s) and the first vowel

2. What is the term for the part of the syllable that includes the vowel and what follows?

   a. blends

   b. digraphs

   c. onset

   d. rime

3. "Say cowboy. Now say cowboy without boy." What type of activity is this?

   a. syllable blending

   b. syllable deletion

   c. syllable segmentation

   d. phonemic awareness

4. "Which word does not rhyme: tank, back, bank." What type of activity is this?

   a. phonemic awareness

   b. rhyme detection

   c. alliteration

   d. rhyme production

5. Phonological awareness is

   a. The ability to unblend sounds in words

   b. **Metalinguistic awareness of all levels of the speech sound system**

   c. An awareness of and the ability to manipulate the smallest unit of sounds in speech

   d. The phonetic transcription of a word

6. "What is the third sound in the word boat?" This is an example of:

   a. phoneme isolation

   b. phoneme segmentation

   c. phoneme transposition

   d. phoneme deletion

7. "Say mile. Now say mile one sound at a time." This is an example of:

   a. phoneme isolation

   b. phoneme segmentation

   c. phoneme transposition

   d. phoneme deletion

8. "Say tool. Now have the /t/ and /l/ change places. What word do you have?" This is an example of:

   a. phoneme isolation

   b. phoneme substitution

   c. phoneme transposition

   d. phoneme deletion

9. The smallest speech sound that if changed changes the word is a/n:

   a. syllable

   b. phoneme

   c. morpheme

   d. phonics

10. An awareness of and the ability to manipulate the smallest unit of sounds in speech is:

    a. phonological awareness

    b. phonemic awareness

    c. morphological awareness

    d. etymological awareness

11. Analytic phonics

    a. An instructional process that begins with the parts and moves to the whole

    b. An instructional process that begins with the whole and moves to the parts

    c. An instructional process taught indirectly through the integration of literacy concepts

    d. An instructional process that teaches sound symbol correspondence

12. An instructional process that begins with the parts and moves to the whole

    a. phonetics

    b. analytic phonics

    c. synthetic phonics

    d. phonology

13. Two adjacent vowels in the same syllable whose sounds blend together with a glide or shift is a:

    a. diphthong

    b. vowel blend

    c. vowel digraph

    d. vowel pair

14. Which is not a syllable type:

    a. open syllable

    b. closed syllable

    c. consonant le / final stable syllable

    d. consonant digraph syllable

15. What is a consonant blend?

    a. A cluster of two or three adjacent consonants pronounced so that each consonant keeps its own identity

    b. A combination of two or three consonants that make an unexpected sound

    c. Two adjacent consonants that make one speech sound

    d. Two or three adjacent consonants

16. A grapheme is

    a. A letter or group of letters with one vowel sound

    b. A single speech sound

    c. The written letter or letters that represent a speech sound

    d. The phonetic transcription of a word

17. In the initial position, how do you commonly spell /k/ before e, i, or y?

    a. ck

    b. k

    c. c

    d. ch

18. When adding a vowel suffix to a base word, when do you double the final consonant?

    a. When the base word ends in one short vowel then one consonant

    b. **When the base word ends in an accented syllable ending in one vowel then one consonant**

    c. When the base word ends in two vowels and a consonant

    d. When the base word ends in an unaccented syllable ending in one vowel then one consonant

19. What are the requirements for changing y to i?

    a. Change y to i when adding a vowel suffix.

    b. Change y to i when adding any suffix.

    c. For base words ending in consonant y, change y to i except when adding a suffix that begins with i.

    d. For base words ending in vowel y, change y to i except when adding a suffix that begins with i.

20. Why is the e dropped in recharging but not rechargeable?

    a. English is variable, there is no reason.

    b. English consistently is inconsistent.

c. English spelling principles require the e to soften the g.

d. English spelling principles drop silent e when adding a one syllable suffix.

21. Which characteristic signals a word is of Greek origin?

a. Words that are common everyday words

b. Words where digraph ch is pronounced /sh/

c. **Words where digraph ch is pronounced /k/**

d. Words that end in ff

22. All of the following are characteristics of words of Anglo-Saxon origin except:

a. Words that are short, common, everyday words

b. The names of forest animals

c. Words ending in ct

d. Words with hard g before e, i, or y

23. What characteristic signals a word is of Latin origin?

a. Words that are common everyday words

b. Words with ow

c. Words with ci pronounced /sh/

d. Words that are science based

24. A suffix that changes the part of speech of the base word is a:

a. derivational morpheme

b. inflectional morpheme

c. free morpheme

d. allomorph

25. A morpheme is

a. The smallest meaningful unit of language

b. A single speech sound

c. The written letter or letters that represent one speech sound

d. The phonetic transcription of a word

26. How many syllables are in the made-up word: remanishable

a. 4

b. 5

c. 6

d. 7

27. Which word matches the rime in make:

a. ache

b. steak

c. ace

d. lake

28. How many syllables are in the made-up word: supertippleless

a. 3

b. 4

c. 5

d. 6

29. How many syllables are in the word: misadministration

a. 4

b. 5

c. 6

d. 7

30. How many syllables are in the word: disestablishmentarianism

    a. 6

    b. 7

    c. 8

    d. 9

31. What do the phonemes /t/ as in table, /p/ as in pig, and /k/ as in cup have in common?

    a. continuant

    b. unvoiced

    c. fricative

    d. voiced

32. Cognate phonemes are formed with the same mouth position but different voicing. What is the cognate to /b/ as in bat?

    a. /t/ as in table

    b. /d/ as in dog

    c. **/p/ as in pig**

    d. /g/ as in goat

33. How many phonemes are in the word plight?

    a. 3

    b. 4

c. 5

d. 6

34. Determine which pair of words has an underlined grapheme that does not represent the same sound. For example, the underlined grapheme in try and candy do not represent the same sound.

a. pail - said

b. cot - water

c. park - school

d. slow - though

35. How many phonemes are in the word fox?

a. 1

b. 2

c. 3

d. 4

36. Which word contains the same sound of "n" as in anchor?

a. bunny

b. nap

c. can

d. ring

37. If pliding is a word, the "i" would sound like the "i" in:

a. flip

b. fight

c. priest

d. division

38. Why is the e pronounced /ĕ/ in wet but /ē/ in we?

a. English is variable; there is no reason.

b. We is an irregular word.

c. English principles state that 2 letter words or syllable have long vowels.

d. The e in wet is a closed syllable and the e in we is an open syllable.

39. In the made-up word snopkin, where is the word divided?

a. before the p

b. between the p and k

c. after the k

d. No division needed

40. In the made-up word roble, what syllable type is the first syllable

a. open

b. closed

c. r-controlled

d. consonant-l-e

41. Map graphemes to phonemes for the word glade. Each phoneme is contained between "/ /" and corresponds to one grapheme. For example: pack /p/ /ă/ /k/

a. /gl/ /ā/ /d/

b. /g/ /l/ /ā/ /d/

c. /gl/ /ā/ /d/ /e/

d. /g/ /l/ /ā/ /d/ /e/

42. How would you spell the word formed from the made-up word drap plus suffix er?

    a. draper

    b. drapper

    c. dapper

    D. drappeer

43. Which word is an exception to the regular spelling principles for English?

    a. endless

    b. over

    c. skunk

    d. bookkeeper

44. Identify the word with the least common spelling situation for long o.

    a. boat

    b. robe

    c. open

    d. row

45. Identify the word with the least common spelling situation for long u:

    a. few

    b. muse

    c. blue

    d. uniform

46. How many morphemes are in elephant?

    a. 1

b. 2

c. 3

d. 4

47. How many morphemes are in rejections?

a. 1

b. 2

c. 3

d. 4

48. How many morphemes are in incredible?

a. 1

b. 2

c. 3

d. 4

49. How many morphemes are in snowballs?

a. 1

b. 2

c. 3

d. 4

50. How many morphemes are in thermometer?

a. 1

b. 2

c. 3

d. 4

SURVEY B

1. What is the term for the initial consonant(s) before the first vowel in a word?

   a. blend

   b. digraph

   c. onset

   d. rime

2. A rime is:

   a. the part of the syllable that includes the vowel and what follows

   b. the final consonants in a syllable

   c. the final three letters of a word

   d. the final syllable of a word

3. "What word do these sounds make: air plane?" This is what type of activity?

   a. syllable blending

   b. syllable deletion

   c. syllable segmentation

   d. phonemic awareness

4. "Tell me a word that fits at the end of this sentence: The fat cat sat on the _____." What type of activity is this?

   a. rhyme detection

   b. rhyme generation

c. rhyme blending

d. phonemic awareness

5. A metalinguistic awareness of various levels of the speech sound system is:

   a. phonemic awareness

   b. **phonological awareness**

   c. phonetics

   d. phonology

6. "What is the second sound in the word tape?" This is an example of:

   a. phoneme isolation

   b. phoneme segmentation

   c. phoneme transposition

   d. phoneme deletion

7. "Say sky. Now say sky one sound at a time." This is an example of:

   a. phoneme isolation

   b. phoneme segmentation

   c. phoneme transposition

   d. phoneme deletion

8. "Say mile. Now have the /m/ and /l/ change places. What word do you have?"

   This is an example of:

   a. phoneme isolation

   b. phoneme substitution

   c. phoneme transposition

   d. phoneme deletion

9. A phoneme is

    a. A letter or group of letters with one vowel sound

    b. Smallest speech sound that if changed changes the word

    c. The written letter or letters that represent a speech sound

    d. The study of sounds within words

10. Phonemic awareness is

    a. The ability to unblend sounds in words

    b. An awareness of various levels of the speech sound system

    c. An awareness of and the ability to manipulate the smallest unit of sounds in speech

    d. The phonetic transcription of a word

11. An instructional process that begins with the whole and moves to the parts is

    a. phonetics

    b. analytic phonics

    c. synthetic phonics

    d. phonology

12. Synthetic phonics

    a. An instructional process that begins with the parts and moves to the whole

    b. An instructional process that begins with the whole and moves to the parts

    c. An instructional process taught indirectly through the integration of literacy concepts

    d. An instructional process that focuses on whole words.

13. A diphtong is:

    a. Two adjacent vowels in the same syllable whose sounds blend together glide or a shift

    b. Two adjacent vowels in the same syllable that make an unexpected sound

    c. Two adjacent vowels in the same syllable that make one vowel sound

    d. Two adjacent vowels in the same syllable that retain their own sound

14. How many syllables types are in the English language:

    a. 4

    b. 5

    c. 6

    d. many

15. A cluster of two or three adjacent consonants pronounced so that each letter keeps its own identity is called:

    a. consonant digraph

    b. silent consonant

    c. diphthong

    d. consonant blend

16. The written letter or letters that represent a speech sound is:

    a. phoneme

    b. grapheme

    c. morpheme

    d. allomorph

17. In the initial position, how do you commonly spell /k/ before a, o, or u or consonants?

    a. ck

    b. k

    c. c

    d. ch

18. What is not a checkpoint when applying the doubling rule?

    a. Is the final syllable accented?

    b. Does the base word end in one short vowel then one consonant?

    c. Does the base word end in one vowel then one consonant?

    d. Are you adding a vowel suffix?

19. What is not a checkpoint when applying the floss rule?

    a. Is it a one syllable base word?

    b. Does it end in /f/, /l/, or /s/?

    c. Is the vowel short?

    d. Does the base word end in one vowel then one consonant?

20. Why is there a final silent "e" in have, starve, and solve?

    a. English spelling is inconsistent.

    b. English spelling principles state that English words do not end in "v."

    c. English spelling requires and extra letter.

    d. The words are rimes.

21. Words with "ch" pronounced /sh/ clue the reader the word is

    a. Anglo-Saxon

b. Latin

c. Greek

d. French

22. Words with silent letters such as "kn" and "gn" clue the reader the word is

a. Anglo-Saxon

b. Latin

c. Greek

d. French

23. Words ending in "ct" clue the reader the word is

a. Anglo-Saxon

b. Latin

c. Greek

d. French

24. A suffix that does not change the part of speech of the base word is a/n:

a. derivational morpheme

b. inflectional morpheme

c. free morpheme

d. allomorph

25. What is the smallest unit of meaning of language?

a. phoneme

b. allomorph

c. morpheme

d. phonetics

26. Identify the word that matches the onset in the word splash:

    a. sash

    b. spat

    c. spleen

    d. stash

27. How many syllables are in the word: antiestablishmentarian

    a. 6

    b. 7

    c. 8

    d. 9

28. If "unchimblenessly" is a word, how many syllables would it have?

    a.3

    b. 4

    c. 5

    d. 6

29. How many syllables are in the word: disproportionately

    a. 4

    b. 5

    c. 6

    d. 7

30. If "renuplishmentic" is a word, how many syllables would it have?

    a.3

b. 4

c. 5

d. 6

31. /t/ as in table and /d/ as dog are both

a. stops

b. nasals

c. fricatives

d. glides

32. Cognate phonemes are formed with the same mouth position but different voicing. What is the cognate to /k/ as in cat?

a. /t/ as in table

b. /d/ as in dog

c. /p/ as in pig

d. /g/ as in goat

33. How many phonemes are in the word mixes?

a. 4

b. 5

c. 6

d. 7

34. Determine which pair of words has an underlined grapheme that does not represent the same sound. For example, the underlined grapheme in try and candy do not represent the same sound.

a. gym - jar

b. p<u>ie</u> - w<u>i</u>ld

c. s<u>u</u>n - c<u>o</u>me

d. <u>a</u>pple - squ<u>a</u>d

35. How many phonemes are in the word through?

a. 1

b. 2

c. 3

d. 4

36. If wamble is a word, the "a" would sound like the "a" in:

a. apple

b. tape

c. squad

d. oval

37. If mucip is a word, the "c" would sound like the "c" in:

a. city

b. chef

c. crane

d. churn

38. What is the best description of the underlined syllable of pil<u>grim</u>

a. Closed accented syllable

b. Closed unaccented syllable

c. Open accented

d. Open unaccented

39. In the made-up word truffin, where is the word divided?

    a. between the f's

    b. before the first f

    c. after the second f

    d. No division needed

40. In the made-up word mifle, what syllable type is the second syllable

    a. open

    b. closed

    c. r-controlled

    d. consonant-l-e / final stable syllable

41. Map graphemes to phonemes for the word fox. Each phoneme is contained between "/ /" and corresponds to one grapheme. For example: pack /p/ /ă/ /k/

    a. /f/ /ŏ/ /x/

    b. /f/ /ŏ/ /k/ /s/

    c. /f/ /ō/ /k/ /s/

    d. /f/ /ō/ /x/

42. How would you spell the word formed from the made-up word stan plus suffix ish?

    a. stannish

    b. stanish

    c. staneish

    d. stanneish

43. Which word is an exception to the regular spelling principles for English?

    a. shout

    b. his

    c. those

    d. ocean

44. Identify the word with the least common spelling situation for long e.

    a. tree

    b. we

    c. beach

    d. athlete

45. Identify the word with the least common spelling situation for long a:

    a. spray

    b. eight

    c. made

    d. apron

46. How many morphemes are in raccoon?

    a. 1

    b. 2

    c. 3

    d. 4

47. How many morphemes are in projections?

    a. 1

    b. 2

c. 3

d. 4

48. How many morphemes are in breathed?

a. 1

b. 2

c. 3

d. 4

49. How many morphemes are in airplanes?

a. 1

b. 2

c. 3

d. 4

50. How many morphemes are in photographs?

a. 1

b. 2

c. 3

d. 4

CHAPTER III

ARTICLE II

EXPLORING THE INTERSECTION BETWEEN TEACHERS' CONFIDENCE, DEGREE OF CODE KNOWLEDGE, AND CLINICAL HOURS OF PRACTICE: HANDS ON INTERVENTION EXPERIENCE MATTERS

Abstract

Teachers' belief in their pedagogical efficacy is important especially for teachers who work with struggling readers. This study aimed to characterize the association between contact time teaching students with characteristics of dyslexia, level of code knowledge, and teachers' confidence to teach literacy. Three hundred and eight-two K-12 teachers and dyslexia therapists completed a survey investigating confidence to teach literacy and a psychometrically validated survey investigating code knowledge. Teachers' confidence to teach literacy was significantly different for teachers with varying amounts of clinical contact hours. Post hoc analysis suggested that teachers with >700 clinical hours were the most confident. Next, we examined the interaction between clinical hours and knowledge on confidence. As clinical hours increased, confidence to teach literacy increased moderated by knowledge. Despite 62% of the sample teaching more than 10 years, those with low clinical hours and low knowledge reported the least amount of confidence. Confidence to teach literacy increased with contact time teaching students with characteristics of dyslexia in all levels of knowledge of the elements of English.

This study is part of a larger longitudinal project examining intensive reading intervention teacher training. In this cross-sectional analysis, hands on time working with struggling readers was associated with higher levels of confidence to teach literacy.

Introduction and Literature Review

A reading curriculum provides a foundation for reading instruction. However, reading instruction is not one size fits all (Lyon, 1997). Additionally, a reading curriculum does not make up for a lack of teacher knowledge in the science of English (Cohen, Mather, Schneider & White, 2017; Piasta, Conner, Fishman, & Morrison, 2009), a term noting the structure of the English language with its influences from other languages and building blocks from simple to complex. Therefore, teachers require a spectrum of explicit knowledge and skills to teach early literacy concepts and remediate students with a word level reading weakness such as dyslexia, knowledge often not covered in teacher preparation programs (Seidenberg, 2017). Given the complexity of student composition in the general classroom and the rise of response to intervention (RTI), early literacy teachers require deep knowledge of English constructs in order to provide targeted instruction to those students who require additional support in basic skills in order to catch up. Furthermore, some states specify the instructional content for students with dyslexia (e.g., Connecticut, Tennessee, Mississippi). Dyslexia specific instruction requires explicit knowledge of the structure of language in order to implement.

Teachers, as first line interactors with students, require both explicit knowledge in reading constructs and practice implementing empirically supported instructional practices to have the degree of skill and confidence to impact decoding skills of the diverse learners in their classrooms (Cohen et al., 2017; Ehri & Flugman, 2018; Lyon & Weiser, 2009; Moats & Foorman, 2003). With only a specified amount of time in a day or instructional period, teachers' disciplinary knowledge and pedagogical practices must

be uniquely leveraged to benefit students across a spectrum of strengths and weaknesses. However, historical research suggests that teachers lack the explicit knowledge of the language structure required for direct, explicit, and systematic code instruction (e.g. Moats 1994, 2009; Foorman et al., 2016; Cunningham, Perry, Stanovich & Stanovich, 2004). Furthermore, a lack of explicit code knowledge leads to ineffective instructional practices and poorer student outcomes (Cohen et al., 2017; Piasta et al., 2009).

One way to address the need for more effective reading instruction in classrooms is through additional teacher training beyond initial licensure. In fact, Lyon, Vaassen, and Toomey (1989) recommended that scholarship "must begin to integrate theory and practice" as teachers are prepared "within school settings and under the conditions that teachers will ultimately be faced with as they engage in the complex activities of their profession" (p. 169). Additionally, teachers become empowered as they gain knowledge and confidence in their ability to teach reading (Brady et al., 2009). However, rather than feeling confident in their ability, teachers report feeling unprepared to teach reading. Additionally, teachers demonstrate low levels of code knowledge that may also impact their confidence in teaching basic language constructs to struggling readers including those with characteristics of dyslexia. Therefore, the purpose of this exploratory study is to examine the relationships between clinical hours working with struggling readers, teachers' level of basic English language knowledge (BEEL), and confidence to teach literacy.

In examining teachers' basic English language knowledge and level of literacy related confidence, terminology complicated examining the variable of confidence. Belief, perception, and attitude were used interchangeably in the research to describe

variables related to confidence. For example, studies employing the same survey used different terms for the variable examined. One study used the term perception (Bos, Mather, Dickson, Podhajski & Chard, 2001) and another attitude (Brady et al., 2009). To clarify terminology across studies, surveys measuring confidence were classified as belief, perceived knowledge, preparedness, or self-efficacy. Belief, the messiest variable (Pajares, 1992), included surveys that used the term attitude or perception as well as belief since beliefs influence perceptions and attitudes (Pajares, 1992). Surveys that asked participants to estimate degree of knowledge were categorized as perceived knowledge, and surveys relating to level of preparedness to teach were referred to as preparedness. Finally, surveys asking participants to rate their degree of efficacy in teaching reading were labeled as self-efficacy. See Table 1 for a list of studies examined, type of confidence measured, and sample surveyed. From the literature it was noted that teachers felt unprepared to teach reading. Additionally, teachers held an incongruity between literacy research and classroom practices. Furthermore, studies employing hands on intervention experiences resulted in gains in both teachers' knowledge and confidence.

Unprepared teachers

Teachers report feeling unprepared to teach reading. Lyon, Vaassen, and Toomey (1989) reported 80 – 90% of teachers surveyed felt unprepared to teach reading while at least 94% of teachers did not have field experience working with diverse learners (e.g. individual differences in ability and educational experience as well as cultural differences). Bos et al. (2001) reported that preservice teachers (PST) and in-service teachers (IST) indicated feeling somewhat prepared to teach reading in general as well as

in teaching reading to struggling readers. Teaching reading to struggling readers was the lowest rating reported by Washburn, Joshi, Binks-Cantrell (2011) with a mean score of 1.68 (0.492) on a scale of 1 to 4. Furthermore, Fielding-Barnsley and Purdie (2005) reported that special education teachers, those teachers responsible for servicing students with the most severe reading disabilities, had significantly lower levels in implicit pedagogical concepts than their counterparts in the general education classroom. Meehan and Hammond (2006) surveyed 43 primary and special education PST in their final year of coursework and only 7% felt well prepared to teach reading. In a large study of 2187 PST, Salinger et al. (2010) observed the lowest domain for preparedness to teach reading was Alphabetics (phonemic awareness and phonics). Interestingly, they also noted that level of knowledge was not associated with feelings of preparedness.

The incongruity between research and practice

Researchers also report an inconsistency between literacy research and teachers' level of preparedness, beliefs, practices, and knowledge. Maher and Richdale (2008) reported an incongruity between teachers' level of code knowledge, beliefs in code-based instruction, and actual classroom practices. Maher and Richdale (2008) also noted that teachers primarily implemented whole language instruction in their classrooms. Furthermore, they reported that teachers believed that whole language was the best means for teaching struggling readers, which is contrary to research. Mather, Bos, and Babur (2001) found that teachers' belief in the importance of code-based instruction did not align with teachers' actual knowledge of the structure of language. Mather et al. (2001) concluded this finding suggested that teachers lack the knowledge to effectively teach struggling readers with word level weaknesses. Cunningham, Perry, Stanovich and

Stanovich (2004) observed an incongruity between K-3 teachers who perceived themselves as having higher levels of knowledge in phonemic awareness and code-based components than their actual knowledge performance and concluded the discrepancy between perceived ability and actual ability may inhibit those who need improvement from actually seeking additional professional development or training. However, other researchers noted the opposite relationship between level of knowledge and confidence. In their work with PST in Australia, Tetley and Jones (2014) found a weak but positive relationship between level of construct knowledge in phonological awareness and phonics and confidence to teach the alphabetic principle. They noted this was possibly due to recent changes in coursework taken prior to the study suggesting coursework can improve both knowledge and confidence levels.

Importance of hands on intervention experience

Intervention and tutoring experiences are associated with increased confidence in teaching reading for both PST and IST. PST who used code instruction in their tutoring field experience demonstrated stronger gains in self-reported preparedness to teach reading (Al Otaiba, Lake, Greulich, Folsom, & Guidry, 2012). Similarly, Leader-Janssen and Rankin-Erickson (2013) found that PST who participated in a literacy course with a reading clinic one-on-one tutoring practicum demonstrated significant gains in confidence to teach reading partially mediated by an increase in knowledge over the course of the semester. However, they noted knowledge alone was not responsible for the increase in confidence. Hands on intervention experience has been shown to be helpful for IST as well. Brady et al. (2009) observed that as teachers' knowledge increased in response to a year-long mentoring style of professional development,

confidence to teach children to read was more likely to increase. This increase in teachers' knowledge and confidence in response to training and field experiences suggests that both knowledge and time working with struggling readers impact confidence. Previous research in this area examined PST and IST with some special education teachers. However, there is insufficient research examining teachers participating in dyslexia specific intervention training, a subspecialty of teachers working with students who benefit from direct, explicit, and systematic code instruction. With the rise of new laws requiring specific instructional standards for dyslexia intervention and the delineation of specific training requirements for teachers who work with students with characteristics of dyslexia, it is important to expanded research to include teachers who work with students with characteristics of dyslexia.

Present purpose of research

There is a void in the literature examining a specific population of teachers: dyslexia therapists. Furthermore, teachers who work with struggling readers, should have some degree of confidence in their ability to teach reading and literacy in addition to knowledge of language constructs. However, previous research demonstrated that general education and special education teachers often reported feeling unprepared to teach reading. Studies with tutoring experiences suggested knowledge alone was not the only contributor to teachers' confidence. Additionally, hands on time working with struggling readers in the context of acquiring knowledge through training has been demonstrated as a strong contributor to teacher effectiveness as measured by student reading outcomes (Ehri & Flugman, 2018; McCutchen et al., 2002, McCutchen, Green, Abbott, & Sanders, 2009).

To further examine the association of time teaching struggling readers, knowledge, and confidence, we explored an intensive training model for dyslexia therapists. Dyslexia therapy training is defined by some state laws and certifying organizations (e.g. Academic Language Therapy Association, ALTA; IDA) as training that occurs over two years wherein teachers acquire at least 700 clinical hours of hands on intervention experience delivering a systematic, explicit, and direct literacy lesson 45 to 50 minutes in duration three to four times a week in a small group setting in addition to instructional hours receiving content knowledge. These hands-on clinical hours are obtained during training while under the supervision of a highly qualified instructor who provides feedback and guidance as well as after prescribed training has been completed. Other states define dyslexia teacher training as two hours of professional development in dyslexia (e.g. Tennessee) with no application of training in clinical practice.

As laws governing the identification of dyslexia, instructional requirements of dyslexia specific intervention, and teacher training requirements increase, it is important to examine aspects of these laws' requirements through research especially since some laws require workshop style training with no clinical hour requirements while other states require more intensive forms of training. Therefore, we examined the association between clinical hours working with struggling readers and confidence to teach reading and literacy with a cross sectional sample of teachers with varying clinical hours conducting literacy intervention with students with characteristics of dyslexia from both workshop and intensive training models. Given that there is little research in this area, this study is exploratory in nature and follows an observational design. The study is designed to examine associations between levels of clinical hours teaching students with

characteristics of dyslexia and confidence to teach literacy. Additionally, to further explore variables that impact teachers' confidence, we examined if an interaction between knowledge of the basic elements of English (BEEL) and clinical hours exists when predicting confidence.

The following research questions guided this study:

- Are there differences in confidence to teach literacy among teachers with varying clinical hours working with students with characteristics of dyslexia?
- How does the effect of clinical hours on teachers' confidence vary based on teachers' knowledge of the basic elements of English?
    - What it the effect of clinical hours on confidence?
    - What is the effect of knowledge on confidence?
    - What is the conditional effect of clinical hours as moderated by knowledge on confidence?

Methods

Participants

Three hundred and eighty-two certified teachers and dyslexia therapists who completed all survey information participated in this study. Participants were recruited from training centers located in southern states of the U.S. that had laws regarding dyslexia. Highest level of education was relatively balanced with 48.7% holding a bachelor's degree and 51.3% with a master's degree. The majority were female (93.7%) elementary teachers (64.4%) with greater than 10 years of teaching experience (61.7%).

Some participants were recruited from a workshop covering reading and literacy for students with characteristics of dyslexia in a state requiring two hours of training in

dyslexia with no clinical hours working with this specific population. These participants were classified as the workshop low clinical hours group. The other participants were recruited from states offering dyslexia specific certification or requiring advanced degrees covering dyslexia specific instruction and intervention (DSI^2) that requires clinical hours working with students identified with characteristics of dyslexia. These participants were grouped as DSI^2 low, DSI^2 medium, or DSI^2 high clinical hours according to clinical hours reported. Refer to Clinical Hours for additional descriptions. See Table 3.2 for characteristics of participants.

Materials

Confidence. Teachers rated their pedagogical efficacy in phonemic awareness, multi-sensory literacy instruction, spelling, vocabulary, fluency, comprehension, written expression, teaching students with reading disabilities, teaching reading to ELL, and using assessment to inform instruction. Ratings were based on a 5-point Likert scale with 1 indicating not effective at all, 2 slightly effective, 3 moderately effective, 4 very effective, and 5 extremely effective. The questions were slightly modified from previous research (Binks, 2008; Stark, Snow, Eadie, & Goldfeld, 2016; Washburn, Joshi, & Binks-Cantrell, 2011).

Knowledge. Teachers completed a psychometrically validated assessment of knowledge of the structure of the English language. The instrument contained 50 questions covering phonological sensitivity, phonemic awareness, decoding, encoding, and morphology. See McMahan, Jin, Oslund, & Kim (2019) for more information regarding validation and test items.

Clinical Hours. Hours of clinical practice were grouped as low = 0 to 60, medium = > 60 to 700, and high > 700. These groupings of hours of practice aligned with levels of clinical hours noted in some state laws concerning teachers who work with students with characteristics of dyslexia. For example, Texas provides certification as a Licensed Dyslexia Practitioner or Licensed Dyslexia Therapist. The practitioner level requires at least 60 hours of clinical practice. Therefore, 60 or less hours were considered low clinical hours. Texas also provides certification as a Licensed Dyslexia Therapist that requires at least 700 clinical hours of practice. Therefore, greater than 700 clinical hours was considered high. The range between these levels was deemed medium.

Procedures

Trained proctors provided informed consent and the survey packet containing background information, confidence to teach literacy, and the knowledge test. The packets were completed in a classroom setting and took approximately 30 minutes to complete, although it was administered under untimed conditions. Completed packets were entered and approximately 10% were pulled to verify accuracy of entry. Confidence was computed from the sum of items examined in the confidence to teach literacy survey. Knowledge was an IRT calibrated theta score calculated in *Xcalibre*.

Analysis and Results

Assumptions

An analysis of standard residuals for confidence suggested normal distribution with no extreme outliers (Std. Residual Min = -3.06, Std. Residual Max = 2.77). To further explore distribution, an examination of *z-scores* suggested 94.8% fell within normal distribution limits. A visual inspection of group histograms and Q-Q plots and

examination of skew and kurtosis suggested normality within groups. The scatterplot of standardized residuals suggested the assumptions of linearity and homogeneity of variance were met, which was supported by a non-significant Levene's test, $F(3, 378) = 2.08$, $p = .103$. Multicollinearity was not a concern (Clinical Hours, Tolerance = .71, VIF = 1.40; IRT Calibrated Theta, Tolerance = .71, VIF = 1.40). The data met the assumption of independence of errors (Durbin-Watson = 2.09). Visual inspection of the histogram of standardized residuals and P-P plots suggested normally distributed errors.

Research question 1

Confidence. For research question 1, we conducted a one-way ANOVA to examine differences in confidence by levels of clinical hours. Based on hours of clinical practice and training type selection, participants were classified into four groups: workshop low ($n = 72$), DSI^2 low ($n = 104$), DSI^2 medium ($n = 100$), and DSI^2 high ($n = 106$). Confidence was significantly different for different levels of clinical hours, $F(3, 378) = 44.60$, $p < .001$, $\eta^2 = 0.26$. Post-hoc comparison using the Tukey-Kramer test, chosen to account for differences in group sizes with equal variances, revealed all groups were statistically significant from each other (see Table 3.3). However, the difference between the workshop low and DSI^2 medium hours approached non-significance, $p = .050$.

The workshop low group ($M = 34.89$, $SD = 4.97$) demonstrated significantly greater confidence than the DSI^2 low hours group ($M = 32.55$, $SD = 6.44$), $p = .040$, $g = 0.40$. This suggests that on average the workshop low hours group reported greater levels of confidence than the DSI^2 low hours group. The DSI^2 medium hours group ($M = 37.16$, $SD = 5.44$) demonstrated statistically greater confidence than the DSI^2 low hours group, p

< .001, $g = 0.77$. However, the workshop low group's confidence level was closer to the confidence reported by the DSI[2] medium hours. This suggests that on average those with DSI[2] medium level of clinical hours were more confident than those with DSI[2] low clinical hours, but closer in confidence with those in the workshop low group. The DSI[2] high hours group ($M = 41.37$, $SD = 5.65$) demonstrated significantly greater confidence than the workshop low hours group, $p < .001$, $g = 1.20$, the DSI[2] low hours group, $p < .001$, $g = 1.46$, and the DSI[2] medium hours group, $p < .001$, $g = 0.76$. This suggests that on average participants with DSI[2] high levels of clinical hours were the most confident in their ability to teach literacy.

Probe the workshop group. To explore if there were differences in education, years teaching, or level of knowledge of the elements of English that may have attributed to differences in confidence between the workshop low clinical hours group and the DSI[2] low clinical hours group, we conducted an independent samples T-test. There were no significant differences in education $t(174) = 1.44$, $p = .151$, years teaching $t(174) = -0.90$, $p = .370$, or knowledge $t(174) = -0.74$, $p = .463$. This suggests that the workshop low hours group demonstrated similar levels of knowledge as those with DSI[2] low hours yet were significantly more confident.

Given that the workshop low group was more similar in confidence to the DSI[2] medium hours group, we looked at differences in knowledge between these groups. There were significant differences in knowledge $t(169.99) = -6.05$, $p < .001$. This suggests that on average the workshop low group was less knowledgeable but demonstrated confidence levels that approached similarity as those participants who had more clinical hours working with students with characteristics of dyslexia. Taken

together, the results might suggest that teachers who seek less intensive dyslexia training such as workshops may be overly confident in their ability to teach literacy that may inhibit them from seeking more intensive training.

Research question 2

For question 2, we conducted a moderated regression analysis using PROCESS (Hayes, 2018b) with those teachers participating in or who completed dyslexia therapy training. We were interested in examining if knowledge of the elements of English moderated the relationship between clinical hours and confidence to teach literacy. The model significantly explained teachers' confidence, F (3, 306) = 45.09, $p < .001$, with an R^2 of .31. In keeping with Hayes (2018a) recommendation to report unstandardized metrics, coefficients are reported unstandardized to allow for comparison across studies using the same measures because standardized coefficients are "scaled in terms of variability in the sample" and do not lend themselves to comparison "across studies conducted by different investigators" (p. 519).

The antecedent and moderator where mean centered prior to analysis to aid in interpretation of b_1 and b_2. Clinical hours (b_1 = 3.66) was statistically different from zero, t(306) = 7.84, $p < .001$. Knowledge (b_2 = 1.29) was statistically different from zero, t(306) = 3.04, p = .0026. Furthermore, the interaction between clinical hours and knowledge (b_3 = -1.03) was statistically different from zero, t(306) = -2.16, p = .0317. A test of highest order unconditional interaction was significant, F (1, 306) = 4.66, p = .0317, ΔR^2 = .011. Therefore, knowledge of the elements of English moderated the relationship between clinical hours and confidence to teach literacy.

For different values of knowledge (mean and +/- 1 SD), clinical hours' effect on confidence was different. There was a significant positive relationship between clinical hours and confidence at 1 SD below the mean (b = 4.60, 95%CI [3.39, 5.81], t = 7.49, p < .001), the mean (b = 3.66, 95%CI [2.74, 4.58], t = 7.84, p < .001), and 1 SD above the mean (b = 2.72, 95%CI [1.42, 4.03], t = 4.11, p < .001) of knowledge. Findings suggest that regardless of level of knowledge, teachers with more clinical hours reported a higher level of confidence in their pedagogically efficacy to teach literacy. However, as knowledge increased, the strength of the relationship between clinical hours and confidence decreased. See Figure 3.1 to visualize these conditional effects using the Johnson-Neyman technique (Hayes, 2018b).

Discussion and Conclusion

The first aim of this observational study examined differences in levels of confidence to teach literacy among teachers with varying clinical hours working with students with characteristics of dyslexia. Findings showed that teachers with more hands-on experience teaching students with characteristics of dyslexia reported higher levels of confidence to teach literacy. Despite 62% of the sample having taught over 10 years, confidence to teach literacy was lower for those with low levels of clinical supervised teaching hours. Additionally, teachers with similar clinical hours, education, teaching experience, and level of knowledge of English constructs who elected to attend a workshop training for dyslexia were more confident than those who elected to attend a two-year dyslexia intervention training. Furthermore, the workshop teachers' incongruity between reported confidence and demonstrated knowledge was similar to the findings of Maher and Richdale (2008), which was also reported by Washburn, Joshi, and Binks-

Cantrell (2011). As Cunningham et al. (2004) suggested, this discrepancy is worrisome as overconfidence may inhibit less knowledgeable teachers from seeking training. Furthermore, these findings suggest that the workshop group lacked self-awareness of how much they did not know that led to self-inflated assessment of their pedagogical efficacy, an example of the Dunning-Kreuger effect (Kruger & Dunning, 1999). States vary in their requirements of clinical practice hours in association with dyslexia specific instruction training. Findings from this study suggested that teachers with >700 clinical hours of practice were associated with the highest level of confidence to teach literacy.

Unraveling the measurable characteristics that may attribute to teacher effectiveness, requires examining the relationships between variables. The second aim of this study explored the relationships between clinical hours working with students with characteristics of dyslexia, teachers' level of basic elements of English knowledge, and teachers' confidence to teach literacy. Results demonstrated that clinical hours working with students with characteristics of dyslexia positively impacted teachers' confidence to teach literacy regardless of the level of knowledge of basic elements of English. Furthermore, findings suggested that teachers at the lower end of clinical hours and knowledge reported lower levels of confidence. However, for those teachers at the higher end of clinical hours, the opposite was observed. Hands on experience working with students with characteristics of dyslexia differentiated levels of confidence among teachers moderated by knowledge.

This study was not designed to examine if more confident teachers were more effective at delivering literacy instruction, but it does add to the body of literature that notes the benefit associated with time working with students on teachers' confidence (e.g.

Brady et al., 2009). Additionally, the study was not designed to examine the efficacy of training methods at increasing teachers' confidence. However, given the limited research in the field of dyslexia therapy, it does lay a foundation for future research. Additionally, the study fills a void in the literature examining the association of hands-on experience and teachers' confidence to teach literacy in the area of dyslexia specific intervention.

Professionals such as speech and language pathologists require 375 clinical / contact hours in their master's program followed by a year of clinical fellowship consisting of 1,260 clinical hours over a minimum of 36 weeks before becoming certified (American Speech-Language-Hearing Association, ASHA, 2019). Similarly, some professional organizations and states offer dyslexia therapist certification (e.g. Certified Academic Language Therapist, Licensed Dyslexia Therapist) that requires 700 supervised clinical hours acquired over two years and 200 classroom instructional hours, among other requirements. Time and research are needed to examine whether this model of dyslexia therapy certification designate those with the highest level of confidence, knowledge, and experiences that brings about increases in the literacy rates of students with characteristics of dyslexia.

Future research should focus on gains observed over the course of training, comparing different training models, and ultimately examine student word reading growth as well. A decade ago, Lyon and Wiser (2009) suggested that teachers work in the environment in which they will teach. Requiring clinical hours of practice in the setting in which teachers will teach supervised by expert-level instructors may provide a viable avenue of equipping teachers with real world practice teaching students with

characteristics of dyslexia and ultimately gain confidence in their ability to teach this specific population literacy.

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Table 3.1 Teacher knowledge studies measuring confidence

Reference	Description of measure	Confidence				Participants		
		PSE	PPN	PKN	BEL	PST	IST	SPE
Al Otaiba & Lake (2007)	On a 5 point Likert scale, 13 items examined preparedness to teach domains of reading instruction.		X			X		
Al Otaiba, Lake, Greulich, Folsom, & Guidry (2012)	See Al Otaiba & Lake (2007).		X			X		
Bos, Mather, Dickson, Podhajski, & Chard, (2001)	On a 6 point Likert scale, 15 items examined literacy beliefs in implicit code, explicit code, and best practices.				X	X	X	
Brady et al. (2009)	On a 5 point Likert scale, 17 items examined pedagogical self-efficacy, 8 items covered beliefs regarding reading instruction, and 34 items examined beliefs in professional development.	X			X		X	
Chapman, Greaney, Arrow, & Tunmer (2018)	On a 4 point Likert scale, 8 items examined pedagogical self-efficacy of domains of literacy instruction.	X					X	
Cohen, Mather, Schneider, & White (2017)	On a 5 point Likert scale, X items examined preparedness to teach reading to struggling readers.		X				X	

BEL = Belief; IST = In-service teachers; PKN = Perceived knowledge; PPN = Preparedness; PSE = Pedagogical self-efficacy; PST = Preservice teachers; SPE = Special education teachers

Table 3.1 continued

Reference	Description of measure	Confidence				Participants		
		PSE	PPN	PKN	BEL	PST	IST	SPE
Fielding-Barnsley & Purdie (2005)	*Teacher attitudes about early reading and spelling* see Bos et al., 1999.				X	X	X	X
Leader-Janssen & Rankin-Erickson (2013)	*Teacher Efficacy Scale for the Teaching of Reading* examined self-efficacy rating from 0 to 100 in early reading skills, decoding skills, comprehension, metacognition, assessment, and motivation.	X				X		
Maher & Richdale (2008)	On a 6 point Likert scale, 12 items from the *Teacher Perceptions Toward Early Reading and Spelling* were used to examine code instruction and meaning instruction. See Mather, Bos, & Babur (2001). Teachers also completed a confidence rating to teach students from various backgrounds.	X	X		X	X	X	
Mather, Bos, & Babur (2001)	On a 6 point Likert scale, 25 items examined implicit and explicit instructional practices using the *Teacher Perceptions Toward Early Reading and* Spelling, a survey adapted from DeFord (1985).				X	X	X	

BEL = Belief; IST = In-service teachers; PKN = Perceived knowledge; PPN = Preparedness; PSE = Pedagogical self-efficacy; PST = Preservice teachers; SPE = Special education teachers

Table 3.1 continued

Reference	Description of measure	Confidence				Participants		
		PSE	PPN	PKN	BEL	PST	IST	SPE
Meehan & Hammond (2006)	*Teacher Perceptions Toward Early Reading and Spelling* adapted from Mather, Bos, & Babur (2001).				X	X		
Salinger et al. (2010)	Teachers rated themselves over 13 items on levels of preparedness from 0 indicating not at all prepared to 3 indicating definitely prepared.		X			X		
Stark, Snow, Eadie, & Goldfeld (2016)	Teachers rated their pedagogical ability as minimal, moderate, very good, or expert across 10 literacy domains.	X					X	
Tetley & Jones (2014)	On a 5 point Likert scale, teachers rated their confidence to teach literacy in five areas.	X				X		

BEL = Belief; IST = In-service teachers; PKN = Perceived knowledge; PPN = Preparedness; PSE = Pedagogical self-efficacy; PST = Preservice teachers; SPE = Special education teachers

Table 3.2 *Characteristics of participants*

	% Total	Workshop Low	DSI² Low	DSI² Medium	DSI² High
Teaching experience					
0 – 5 years	18.1	23.6	19.2	19.0	12.3
6 – 10 years	17.0	16.7	16.3	20.0	15.1
11 – 15 years	18.3	20.8	19.2	19.0	15.1
16 – 20 years	14.1	15.3	16.3	12.0	13.2
> 20 years	29.3	23.6	28.8	26.0	36.8
Not indicated	3.1	0	0	4.0	7.5
Grade taught					
Elementary K-5	64.4	81.9	76.9	57.0	47.2
Middle 6-8	10.5	15.3	8.7	12.0	7.5
High 9-12	2.9	0	6.7	3.0	0.9
K-12	16.5	2.8	4.8	20.9	34.0
Not indicated	5.8	0	2.9	8.0	10.4

Table 3.3 *Multiple comparisons of clinical hours with Tukey HSD correction*

Clinical Hours		*M* (*SD*)	Mean Diff.	*SE*	*p*	Hedge's *g*
Workshop Low	DSI² Low	32.56 (6.44)	2.33	.87	.040	.40
	DSI² Medium	37.16 (5.44)	-2.27	.88	.050	.43
	DSI² High	41.37 (5.64)	-6.48	.87	.000	1.20
DSI² Low	Workshop Low	34.89 (4.97)	-2.33	.87	.040	.40
	DSI² Medium	37.16 (5.44)	-4.60	.80	.000	.77
	DSI² High	41.37 (5.64)	-8.81	.79	.000	1.46
DSI² Medium	Workshop Low	34.89 (4.97)	2.27	.88	.050	.43
	DSI² Low	32.56 (6.44)	4.60	.80	.000	.77
	DSI² High	41.37 (5.64)	-4.21	.79	.000	.76
DSI² High	Workshop Low	34.89 (4.97)	6.48	.87	.000	1.20
	DSI² Low	32.56 (6.44)	8.81	.79	.000	1.46
	DSI² Medium	37.16 (5.44)	4.21	.79	.000	.76

DSI² = dyslexia specific intervention and instruction

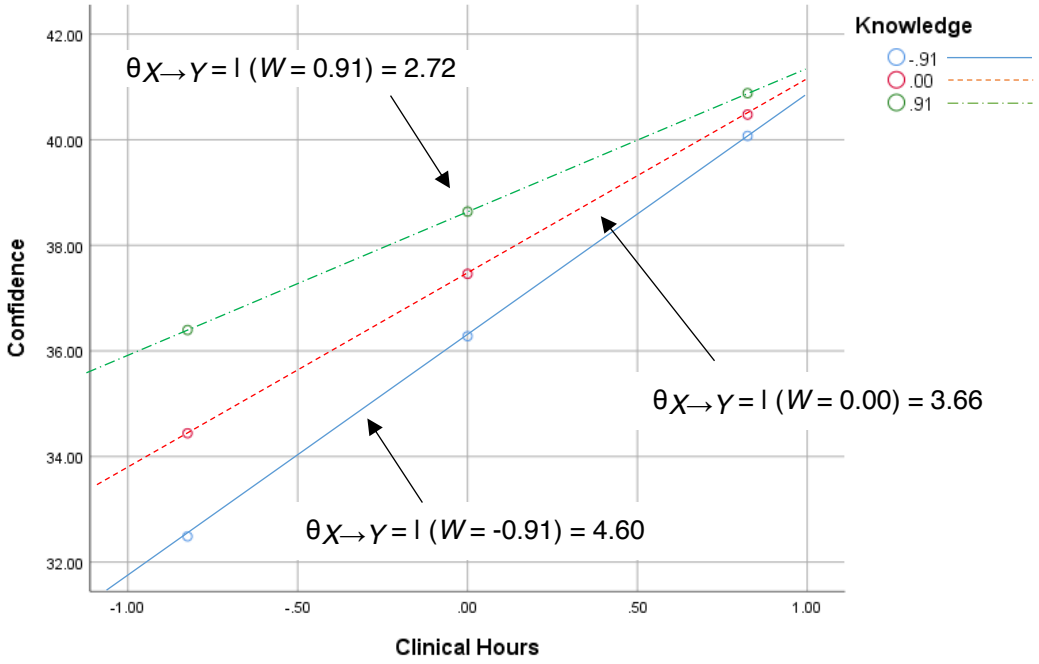

Figure 3.1 *Visualizing the conditional effect of clinical hours (X) on confidence (Y) at -1 SD, the mean, and +1SD of knowledge of basic elements of English language (W)*

CHAPTER IV

CONCLUSION

As more and more states pass laws addressing the screening of students to identify those with characteristics of dyslexia, requirements of dyslexia specific intervention, and teacher training, it is important to examine the effectiveness of training models. Through the years, organizations emerged to advocate for students with dyslexia (e.g. International Dyslexia Association, IDA), accredit teacher training programs (e.g. IDA, IMSLEC), and certify teachers as dyslexia therapists (e.g. Academic Language Therapy Association, ALTA; IDA). Additionally, some states offer specific certification in dyslexia intervention and instruction whereas others do not, leaving instruction to the classroom teacher. Given the limited research of the impact of dyslexia laws at the teacher level, this study contributes to the body of literature by providing a psychometrically validated instrument that measures the basic elements of English and reliably denotes differences in knowledge of teachers with two years of dyslexia therapy training from those with no training. Additionally, the study explored differences associated with levels of hands on experience working with struggling readers and teachers' confidence. Findings suggest those teachers with the highest contact time working with students with characteristics of dyslexia were the most confident. Furthermore, the interaction effect of knowledge of the elements of language and clinical hours on predicting teachers' confidence to teach literacy was examined. The results demonstrated that as clinical hours increased, confidence to teach literacy increased despite level of knowledge.

Student growth and achievement lies in the balance between teacher effectiveness or ineffectiveness (Lyon & Weiser, 2009; Sanders & Rivers, 1996). Effective early literacy and reading intervention teachers demonstrate a high level of explicit knowledge and instructional skillsets in systematic, explicit code instruction (Ehri & Flugman, 2018; Moats & Lyon, 1996; Castles, Rastle & Nation, 2018). However, teachers are not isolated entities. Teachers function within laws and policy, standards, financial resources, and class time. Additionally, teachers bring their own individual variables to the equation such as education, experience, knowledge, and confidence. It is postulated that disentangling the construct of teacher effectiveness involves understanding multiple variables such as teacher knowledge, observed practices, confidence, and school climate to name a few.

These studies aimed to provide an instrument calibrated to examine the fine grain knowledge needed for word level intervention and explore the variables of teachers' confidence to teach literacy, clinical hours working with students with characteristics of dyslexia, and knowledge of the elements of English language. We believe the validated instrument created as part of this research will prove beneficial along with other observational forms in examining the impact of different models of dyslexia training and state law delineated training requirements at the teacher level. Ultimately this research would benefit from student level data to explore the impact of the variables on student's word reading growth.

CHAPTER V

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APPENDIX

IRB APPROVAL LETTER

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

MIDDLE TENNESSEE STATE UNIVERSITY

IRBN001 - EXPEDITED PROTOCOL APPROVAL NOTICE

Wednesday, November 30, 2016

Investigator(s): Karen Melissa McMahan (PI), Timothy N. Odegard (FA), and Jwa Kim
Investigator(s') Email(s): kmm2bm@mtmail.mtsu.edu
Department: Dyslexic Studies, Psychology

Study Title: Validation Study of Tests of Teacher Knowledge of the Structure of the English Language
Protocol ID: **17-2103**

Dear Investigator(s),

The above identified research proposal has been reviewed by the MTSU Institutional Review Board (IRB) through the **EXPEDITED** mechanism under 45 CFR 46.110 and 21 CFR 56.110 within the category *(7) Research on individual or group characteristics or behavior* A summary of the IRB action and other particulars in regard to this protocol application is tabulated as shown below:

IRB Action	APPROVED for one year from the date of this notification	
Date of expiration	**11/30/2017**	
Participant Size	600	
Participant Pool	Teachers, graduates and trainees who have completed or who are entering IMSLEC training	
Exceptions	N/A	
Restrictions	**N/A**	
Comments	N/A	
Amendments	**Date** N/A	**Post-approval Amendments** None

This protocol can be continued for up to THREE years (**11/30/2019**) by obtaining a continuation approval prior to **11/30/2017**. Refer to the following schedule to plan your annual project reports and be aware that you may not receive a separate reminder to complete your continuing reviews. Failure in obtaining an approval for continuation will automatically result in cancellation of this protocol. Moreover, the completion of this study MUST be notified to the Office of Compliance by filing a final report in order to close-out the protocol.

Continuing Review Schedule:

Reporting Period	Requisition Deadline	IRB Comments
First year report	11/30/2017	INCOMPLETE
Second year report	11/30/2018	INCOMPLETE

Final report	11/30/2019	INCOMPLETE

The investigator(s) indicated in this notification should read and abide by all of the 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. Amendments to this protocol must be approved by the IRB. Inclusion of new researchers must also be approved by the Office of Compliance before they begin to work on the project.

All of the research-related records, which include signed consent forms, investigator information 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 expedited procedures can be found here.