Predicting Pathways to Literacy in Tennessee through Early Identification and Preventive Intervention

by

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ABSTRACT

Prior research confirms that students who struggle early with reading will rarely catch up without additional support and direct intensive intervention. These results accrue dramatically over time. It takes four times as long to intervene with a fourth-grade student as it does with a student in late kindergarten (Lyon & Fletcher, 2001). Preventive intervention, based on the predictors from the end of kindergarten, would mean that reading difficulties should not become an obstacle to class participation in reading and in all content areas. This quantitative study seeks to determine which subtest of the universal screener at the end of kindergarten are the optimal combination of predictive skills for reading fluency in third grade. The sample for the study consisted of 616 sets of extant student data from two districts. Data consisted of archived student scores from a common universal screener. Student foundational literacy skills were measured at the end of kindergarten using the Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation. The Oral Reading Fluency subtest was used to measure reading achievement in third grade. This study examined how foundational literacy skills interacted with the variable of fluency. This study addressed two research questions: Research Question 1: Which single subtests of the universal screener: Letter Naming, Letter Sound, or Phoneme Segmentation best predict later reading fluency on the 3rd grade Oral Reading Fluency subtest. Research Question 2: Which combination of subtests of the universal screener best predict later reading fluency on the 3rd grade Oral Reading Fluency subtest. This study seeks to determine the strongest predictors from current universal screening data of kindergarten students. Knowing the areas that most closely indicate later reading fluency would support educator's understanding of which

components are essential to later reading achievement and encourage educators to utilize early identification and preventive interventions.

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CHAPTER I: INTRODUCTION

Introduction

Literacy matters because of the endless doors it opens and the wonders of the world that it unlocks. Never before has so much print been available in the blink of an eye. Computers virtually put the world at our fingertips by allowing fluent readers endless pathways to explore. Beyond computers, printed text can be found in every room in homes, every store in communities, every building in cities, and on the highways between them. Literate individuals read these words effortlessly. Literacy profoundly and invariably affects access to education, medical care, career options, and financial security. Around the world, however, millions of people are functionally illiterate, reading below the basic level, and reading the print they see daily does not come effortlessly to them (Institute of Education Sciences, 2019). For these individuals, the ability to accomplish day to day activities of life such as reading a newspaper, filling out job applications or medical forms, and paying bills may prove challenging if not impossible. Literacy is essential to functioning in today's society. Illiteracy often leads to tragic consequences including lower earnings, poor health, and incarceration at higher rates (Lyon and Chhabra, 2004).

The ability to read is crucial for a child's academic success and is essential to being able to engage with learning in every context. According to the National Research Council, and for the purposes of this paper, reading is defined as a process of getting meaning from print while applying knowledge about letters and sound structure of oral language in an effort to achieve understanding. Ability to read impacts all domains of

study. Students who struggle to read typically fall behind in all subject areas throughout school (Snow, Burns, and Griffin, 1998).

Several theories concerning effective ways to teach reading have evolved throughout the ages. Over time theories come and go in popularity with some having greater success than others. Two approaches that have led the "reading wars" are of particular interest in this study, as are the theories which support them. One popular model to reading is the top-down approach which promotes the whole-to-part method of instruction and does not utilize direct literacy instruction, but suggests that if students are immersed in books, words, and language-rich environments, they will naturally make meanings of words and learn to read. In contrast, instruction that moves from part to the whole would be considered part of the bottom-up theory. Bottom-up reading model emphasizes the ability to decode or put into sound what is seen in the text where readers derive meaning in a linear manner. This study will be rooted in the bottom-up theory of reading instruction as it applies to mastery of components on the continuum of phonics and phonological awareness in a linear manner.

In today's education, most children are not being taught to read based on what scientist know about the process of reading. There has been plethora of research on reading over the past 40 years while this problem hides in plain sight. Through these many years of research, scientist brought to light several truths in the field of reading. The first being that learning to talk is a natural process and occurs without direct instruction when children are surrounded by spoken language, but learning to read is not. The research further indicates that for students to become fluent readers, they need explicit, systematic phonics instruction (Lyon, 1998).

Teacher preparation programs, however, are filled with the ideology that children will learn to read naturally if they are surrounded by books. They insist that children being immersed in mounds and mounds of books is enough and that students will learn to read naturally, without the need for any direct instruction, as prescribed by the whole language approach to reading. The bottom up approach to reading, which is supported by research, supports the belief that reading fluently means one must learn to decode words in a code-oriented approach. These two conflicting approaches to reading instruction led to the "reading wars" which pitted the whole language approach against a code-oriented, scientifically based, bottom up approach. The Simple View of Reading (SVR) was proposed by researchers Gough and Tunmer in 1986 and shows that, while reading is a complex activity, it can be represented as two interdependent processes: word recognition (decoding) and language comprehension. This research was an attempt by Gough and Tunmer to end the "reading wars".

A relative consensus from research evidence has emerged recommending certain components of reading instruction are essential. These five essential components of reading, grounded from research evidence, are phonological awareness, phonics, fluency, vocabulary, and comprehension. Direct, explicit, systematic, and cumulative instruction in all five areas, including phonological awareness and phonics, is required for teaching students to read. It is a tragedy of epic proportions that this scientific evidence has been ignored by teacher preparation programs simply because they choose not to acknowledge the facts. In one study, the National Council on Teacher Quality (NCTQ) considered what future teachers are taught about reading instruction. The sample for the study was 72 randomly chosen education schools where NCTQ reviewed 223 required reading courses. The study included evaluations of course syllabi and a review of 227 required

reading texts. Scores were determined from how well the courses presented the components of the science of reading. Only 15 percent of the colleges provided teachers with minimal exposure to science of reading with course syllabi showing a tendency to dismiss scientific research. Review of the required texts was just at disheartening with only four of the 227 text rated as “acceptable” for a comprehensive textbook (Walsh, Glaser, Wilcox, 2006). Most teachers are not prepared to teach reading because their preparation programs, as well as, required texts do not present the components of the science of reading (Moats, 1999). Therefore, most teachers do not have the training and do not understand the continuums of phonological awareness and phonics as needed to implement research-based reading instruction in their schools. And so, the nation’s literacy crisis continues.

In 2017, thirty-seven percent of fourth grade students in the United States were proficient in reading on the National Assessment of Educational Progress (NAEP) assessment (Institute of Education Sciences, 2007). Reading researchers have conducted studies in classroom after classroom that have shown over and over that virtually all children can learn to read — if approaches are implemented that use what scientists have discovered about how the brain learns to read. Yet America’s literacy crisis continues. (Hanford, 2018).

The Tennessee Department of Education openly acknowledges a similar literacy crisis in Tennessee. Leaders of education in Tennessee concur that reading results have become stagnant and in some cases are declining. In 2017, TNReady results indicated that only thirty-seven percent of fourth grade students had mastered or were on track in reading; and similarly, only thirty-three percent of fourth graders were reading on grade level according to the National Assessment for Educational Progress (NAEP). This trend

in data on TNReady and NAEP clearly demonstrates that the majority of fourth grade students in Tennessee are not at a level of mastery to ensure they will be prepared to approach the path they have chosen for life. Realizing the magnitude of this quandary, the reading initiative Read to be Ready was put in place in an attempt to increase reading results by improving Tier 1 core reading instruction. This literacy initiative, however, failed to take into account the NRP findings or consider the converging evidence of reading research. Instead it leaned heavily toward whole language or balanced literacy approach with very little attention to explicit instruction in foundational skills. So the literacy crisis in Tennessee continued.

The Response to Instruction and Intervention (RTI²) framework was penned in early 2013 and attempted to bring the findings of the National Reading Panel and other scientific research into the forefront of reading instruction and intervention in Tennessee. The RTI² framework is a model that promotes recommended practices for an integrated system connecting general and special education by the use of high-quality, scientifically research-based instruction and intervention. The RTI² framework also called for a more scientific way to screen students for reading deficits using nationally normed skills-based screeners. Once students were identified for extra support beyond core reading instruction, diagnostic assessments were used to drill down to specific skill deficits in phonological awareness and phonics. Next, scientifically research-based interventions were matched to the identified deficits. Scientifically research-based interventions are interventions that produce reliable and valid results. When these interventions are used properly, adequate gains are expected. One oversight in the implementation phase of RTI², however, was that not all teachers were not trained in scientifically research-based instruction, which included the foundational layers of pre-reading and the continuums for

phonological awareness and phonics. Tennessee Department of Education contracted Louisa Moats to create a seven class course for interventionist which was offered to districts without cost beginning in 2013. Although many interventionist attended these classes, without follow-up onsite coaching and support change in instruction did not occur in most classrooms. Even with the free courses being offered, many districts did not see the need for the training and did not send teachers to the courses. Therefore, many teachers were less than effective in teaching reading even with the research-based resources; and, when students were flagged for struggles with reading fluency, teachers often assumed they needed to read and reread to become fluent and seldom considered a deficit in word recognition or decoding. This lack of knowledge around the importance of foundational skills mastery caused most teachers to be oblivious to the fact that foundational skills were not being suggested by the universal screener vendors to be assessed after mid-year of first grade, with or without mastery of alphabetic principle and phonological awareness. Teachers' attention was no longer focused on letter knowledge or phonological awareness since these areas would not appear on the next universal screening. Therefore, many students fell between the cracks for interventions in foundational skills and continued to struggle to read fluently. Early reading skills can be taught in kindergarten, but teachers must have fundamental understanding of how to teach these foundational skills (Moats, 1995).

Moats speaks of several well-documented phenomena, two of which are relevant to this study, that have moved the shift toward RTI in federal education policies. The first of these phenomena is that if students do not learn to read by the end of first grade, there is a very real possibility that they will continue to be poor readers and struggle in all

subject areas through high school (Fletcher, Lyon, Fuchs, & Barnes, 2007). Moats (2017) and Torgesen (1998) agree that preventive intervention in kindergarten and first grade is more effective than waiting until students fall far behind. Torgesen (1998) encourages educators to "catch them before they fall".

The second phenomenon is the importance of early identification. Validated predictive screening measures flag students as early as kindergarten who are at risk of reading disabilities, before serious reading problems can develop, and before a discrepancy between ability and achievement exist (Compton et al., 2010; Good & Kaminski, 2011). "Early identification" can be defined in many ways. In this study, as defined by Poulsen (2018), early identification will mean before actual direct explicit instruction in reading real words occurs, but while foundational skills like letter naming and letter sound correspondence, as well as phonological awareness are being learned. In RTI² it is important to correctly identify students who need support and the level of support that is appropriate. The earlier struggling students are identified the earlier preventive interventions may be implemented. Early identification of reading difficulties is advantageous because it enables preventive intervention and softening or possible prevention of reading difficulties.

The lynchpin to prevent reading failure may well be the ability to understand scientifically-based reading research and a guarantee that it becomes a fundamental part of teaching reading. Research evidence is crucial for discerning effective educational practice.

Context

Tennessee is divided into eight educational regions with each one containing a Center of Regional Excellence (CORE) office staffed with content specific academic consultants including an RTI Interventionist. The interventionist at all of these regional CORE offices support their districts around the implementation of RTI². Each year the interventionist chooses three to five districts with which to work intensively to attain a higher level of implementation of RTI².

The first layer of implementation in the RTI² Framework requires that all students are screened three times per year using a skills-based universal screener to determine areas of deficits in pre-reading and reading to identify struggling students. Support in "intensive support districts" often begins by collaborating with the district's administration to more closely analyze the universal screener data to identify trends and areas of need for support. In summer of 2018, a meeting was held in one of these intensive support districts to discuss concerns from current data and identify possible support areas. Data analysis revealed that large numbers of students in second grade would need Tier 2 and Tier 3 interventions. After considering the implications of this overabundance of students qualifying for RTI², the RTI Interventionist worked collaboratively with the principal to trace this particular set of second grade students back through previous years of universal screener data to where their struggles in reading appeared to begin. Alarmingly, most all of these students now needing RTI² had struggled since kindergarten. Universal screener data for this class of students from the end of their kindergarten year on subtests of Letter Naming Fluency (LNF) and Letter Sound Fluency (LSF) were analyzed. Findings concluded that 92% were not fluent in

letter naming or letter-sounds correspondence and struggled with alphabetic principle. The data also showed struggles for these students in phonological awareness areas as indicated by the Phoneme Segmentation Fluency (PSF) subtest of the universal screener. These findings generated questions concerning non-mastery of these foundational areas of alphabetic principle and phonological awareness at the end of kindergarten and their possible correlation to non-mastery of reading fluency in second grade. Different combinations of these predictor measures could possibly provide the level of predictive accuracy required to identify students in need of preventive intervention.

Problem Statement

Studies confirm that students who struggle early with reading will rarely catch up without additional support and direct intensive intervention (Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1996; Torgesen & Burgess, 1998). Results from this struggling beginning in reading accrue dramatically over time. By determining the strongest indicators from current universal screening data of kindergarten students, educators can utilize early identification and preventive intervention to avert a feeling of defeat that could diminish a child's incentive to keep trying to read.

Preventive intervention, based on the predictors from the end of kindergarten, would mean that reading difficulties should not become an obstacle to class participation in reading and in all content areas. Knowing the areas that most closely indicate later reading fluency would help educators know which components are essential to later reading fluency and should be targeted for mastery by the end of kindergarten. Knowing these predictors would also allow use of universal screeners for early identification of

students. The problem then is to determine the combination of skills that best predict later reading achievement.

Statement of Purpose

The purpose of this study was to determine if the foundational skills subtests assessed at the end of kindergarten with a universal screener were predictors of the subtests of fluency which was assessed three years later. Previous research has shown that different combinations of subtests prove to be more effective predictors than any one single subtests. Research also indicates that although phonological awareness is a strong single predictor of later reading fluency, it is not usually used in the combinations from prior research. Therefore, the potential contribution to prediction, when combined with other variables, remains unknown and the optimal combination of predictive skills has not yet been identified. This study seeks to determine which subtests of the universal screener at the end of kindergarten are the optimal combination of predictive skills for reading fluency in third grade.

Research Questions

Research Question 1: Which single subtests of the universal screener: Letter Naming, Letter Sound, or Phoneme Segmentation best predict later reading fluency on the 3rd grade Oral Reading Fluency subtest?

Research Question 2: Which combination of subtests of the universal screener best predict later reading fluency on the 3rd grade Oral Reading Fluency subtest?

Significance of Study

The U.S. Department of Education and the U.S. Department of Health and Human Services requested that the National Academy of Sciences form a committee to research the prevention of reading difficulties. This committee assessed individual child predictors to determine whether these factors are strongly related to later reading difficulties and if they could be used to identify children who would need prevention, intervention, or remediation. The committee found that many individual factors such as reading readiness, letter identification, and concepts of print were reliably correlated with future reading achievement, but most were not strong enough when considered alone to provide the level of predictive accuracy needed to be beneficial in identifying students for intervention. For this reason, different researchers have chosen several different sets of predictor measures to use in kindergarten. (See Table 1.1) Letter knowledge, word recognition, concepts of print, and writing are among the predictor measures most used in kindergarten batteries. Although research shows that phonological awareness appears to be one of the best indicators of later reading achievement, it was rarely assessed in studies. Therefore, the potential contribution to prediction, when combined with other variables, remains unknown. The optimal combination of predictive skills has not yet been identified. This study seeks to add to the body of knowledge by determining which subtests of the universal screener at the end of kindergarten are the optimal combination of predictive skills for reading fluency in third grade.

Table 1

Study Indicators from lead researchers

Name	Date	Study Indicators											
		Letter Naming Fluency	Letter Sound Fluency	Phonological Awareness	Sight Word Efficiency	Non-Word Reading	Vocabulary	IQ	Language and verbal	Metalinguistic Skills	Print Awareness	Concepts of Print	Working Memory
Bryant P, MacLean M, Bradley L	1990			X			X	X	X				
Cain K, Oakhill J, Bryant	2004								X	X			X
Chaney, C	1992								X	X		X	
Hecht, Burgess, Torgesen , Wagner & Rashotte	2000	X	X	X									
Kirby J, Parilla R, Pffieffer	2003			X									
Muter V, Hulme C, Snowling M, Stevenson J	2004			X			X			X			
Scarborough, H Scarborough, H	1991 1998	X	X	X			X	X		X			
Storch S &Whitehurst G	2002			X						X			
Stuart, M	1995	X	X	X									

Research Plan

Theory used in this study is the bottom-up reading theory. This theory is widely used because of its sequential approach. This theory recognizes reading as a developmental process that is best learned in a way that starts with a foundation and builds with complexity. As applied to this quantitative study, this theory holds that one would expect the independent variables of letter naming, letter sound, and phoneme segmentation to influence the dependent variable of later fluency. A correlational study was chosen to show the relationship between the variables because the bottom-up theory posits that reading is a skill in which students learn to read in a step-by-step way. This approach uses a building-block approach beginning with the groundwork of phonics and phonemic awareness.

Definitions and Abbreviations

Basic reading skills: Basic reading skills include the abilities to identify and manipulate individual sounds in language; to identify printed letters and their associated sounds and to decode written language.

Benchmark: Short term or long-term assessment goal used to indicate grade-level expectations during a specific grade level and at a specific time period (e.g., fall, winter, spring).

Comprehension (reading): The ability to understand and make meaning of text.

Core Curriculum/Instruction (Tier I Instruction): Grade-level instruction provided to all students in the regular education classroom. Core instruction often

includes various instructional orientations to include whole class, small-differentiated groups, collaborative, and individual opportunities for learning. Core instruction is intended to meet the diverse needs of all learners. Materials and lessons used are based on current data and are designed to meet the needs of all students.

Curriculum Based Measurement (CBM): A system for on-going monitoring of student progress through a specific curriculum. Through the use of CBM assessments, teachers assess students' academic performance on a regular basis with very brief tests. Results are used to determine whether students are progressing appropriately from the core (Tier I) instructional program and to build more effective programs for the students who do not benefit adequately from core (Tier I) instruction.

Diagnostic Evaluation/Assessment: Standardized assessments designed to assess the extent to which students are on track to master grade-level standards and to determine individual strengths and concerns of skills. Diagnostic assessments may also provide evidence of curricular strengths and needs in particular skill areas.

Direct Instruction: Direct instruction is an instructional approach that utilizes explicit and structured teaching routines. A teacher using direct instruction models, explains, and guides the students through extended practice of a skill or concept until mastery is achieved. The lessons are fast paced, students are academically engaged, and teachers are enthusiastically delivering instruction. Direct instruction is appropriate instruction for all learners, all five components of reading, and in all settings (whole group, small group, and one-on-one).

Early Intervention: Specialized instruction specifically designed to target skill deficits and provide appropriate instruction to meet the needs of students. Intervention is

provided early in order to prevent future learning disabilities or present academic performance deficits with the goal of maintaining grade-level or above grade-level performance.

Explicit Instruction: Instruction that involves direct, face-to-face teaching that is highly structured, focused on specific learning outcomes, and based on a high level of student and teacher interaction. It involves explanation, demonstration, and practice with topics being taught in a logical order. Another characteristic of explicit teaching is modeling skills, thinking, and behaviors. This also involves the teacher thinking out loud when working through problems and demonstrating processes for students.

Fluency (reading): Reading fluency refers to the ability to read words accurately, quickly, and effortlessly. Moreover, fluency skills include the ability to read with appropriate expression and intonation (prosody). Reading fluency is the ability to read with sufficient accuracy and rate to support comprehension.

Intervention: Support at the school level for students performing below grade-level expectations. Educational professionals determine academic intervention needs of students (determined by ongoing data); choose methods for dealing with academic issues; and, most important, monitor on an ongoing basis whether these methods are resulting in increased student learning and achievement.

Phoneme Segmentation Fluency (PSF): A standardized measure of a student's ability to segment three and four phoneme words into individual phonemes fluently. For example; the examiner says "bat" and the student says /b/ /a/ /t/. PSF is usually measured mid- kindergarten through the spring of first grade.

Phonemic Awareness: The ability to hear, think about, identify, and manipulate the individual sounds (phonemes) in spoken words.

Phonics: Phonics refers to a systematic approach of teaching letters (and combinations of letters) and their corresponding speech sounds. Phonics begins with the alphabetic principle: language is comprised of words made up of letters that represent sounds.

Phonological Awareness: Phonological awareness is a broad skill that includes identifying and manipulating units of oral language - parts such as words, syllables, and onsets and rimes. Children who have phonological awareness are able to identify and make oral rhymes, can clap out the number of syllables in a word, and can recognize words with the same initial sounds like "money" and "mother."

Prescriptive Intervention: An intervention specifically targeted to meet the instructional needs of the student.

Prevention: The practice of providing additional assistance in any academic area to prevent students from falling behind.

Probe: When using Curriculum-Based Measurement (CBM), the instructor administers brief, timed assessments or "probes" made up of academic material taken from grade- level curriculum.

Remediation: Corrective instruction that fills in gaps in understanding, skills, or knowledge.

Research-Based Instruction/Intervention: A research-based instructional practice or interventionist one found to be reliable, trustworthy, and valid based on

evidence to suggest that when the program is used with a particular group of students, the student can be expected to make adequate gains in achievement. Ongoing documentation and analysis of student outcomes helps to define effective practice.

Screening: A quick checklist, survey, or probe used to provide an initial general indicator of levels of performance. Screenings may also include diagnostic assessments to gain more information about a student's academic strengths and/or areas of concern.

Skills-based universal screener: A brief, informative tool used to measure academic skills in six general areas (i.e., basic reading skills, reading fluency, and reading comprehension.

Survey-level assessment: A process for determining foundational skill deficits and instructional level(s). It is effective in establishing where to begin an intervention and determining appropriate, realistic goals for a student.

Systematic: Systematic instruction refers to a carefully planned sequence for instruction. For systematic instruction, lessons build on previously taught information, from simple to complex, with clear, concise student objectives that are driven by ongoing assessment.

Universal Screening Process: A schoolwide screening process that uses multiple sources of data to identify individual student strengths and areas of need and provides districts/schools with accurate information for making informed decisions about skills-specific interventions, reteaching/ remediation, and enrichment for each child.

Universal Screening/Screener: An LEA must administer a nationally normed, skills-based universal screener. A universal screener is a brief screening assessment of

academic skills (i.e. basic reading skills, reading fluency, reading comprehension, math calculation, math problem solving, and written expression) administered to ALL students to determine whether students demonstrate the skills necessary to achieve grade level standards. Universal screening reveals which students are performing at or above the level considered necessary for achieving long-term success (general outcome measures). This data can also serve as a benchmark for measuring the improvement of a group, class, grade, school or district. Furthermore, universal screening can be used to identify students in need of further intervention due to identified skill deficits. A more precise assessment may be needed to determine a student's specific area(s) of deficit before beginning an intervention.

Overview of Dissertation

Prior research confirms that students who struggle early with reading will rarely catch up without additional support and direct intensive intervention (Torgesen, 1998). Results from this struggling beginning in reading accrue dramatically over time. The National Institute of Child Health and Human Development (Lyon & Fletcher, 2001) asserts that it takes four times as long to intervene with a fourth-grade student as it does with a student in late kindergarten. Struggling readers who are not identified early and do not receive early intervention tend to fall further and further behind in school. Preventive intervention, based on the predictors from the end of kindergarten, would mean that reading difficulties should not become an obstacle to class participation in reading and in all content areas. This quantitative study sought to determine which subtests of the universal screener at the end of kindergarten are the optimal combination of predictive skills for reading fluency in third grade. The sample for the study consisted of

approximately 616 sets of extant student data from two districts. Data consisted of archived student scores from a common universal screener. Student foundational literacy skills were measured at the end of kindergarten using the Letter Naming Fluency, Letter Sound Fluency, Phoneme Segmentation Fluency subtests. The Oral Reading Fluency subtest was used to measure reading achievement at the end of third grade. This correlational study examined how these foundational literacy skills interacted with the variable of fluency. The proposed study addresses two research questions. Research Question 1: Which single subtests of the universal screener: Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation best predict later reading fluency on the 3rd grade Oral Reading Fluency subtest? Research Question 2: Which combination of subtests of the universal screener best predict later reading fluency on the 3rd grade Oral Reading Fluency subtest? This study seeks to determine the strongest predictors from current universal screening data of kindergarten students. Knowing the areas that most closely indicate later reading fluency would support understanding of which components are essential to later reading achievement and allow educators to utilize early identification and preventive interventions.

CHAPTER II: LITERATURE REVIEW

Research Findings on Teaching Reading

This literature review considers research findings related to how children learn to read, how teachers can best implement preventive reading interventions, and the role of early identification through the Response to Instruction and Intervention Framework. This literature review begins with the a review of two-well-known summaries of research on how reading is most effectively taught (Adams, 1990; Chall, 1967) and then moves to overviews of the findings of two more recent reports from the National Reading Panel and the National Research Council (NRC) called *Preventing Reading Difficulties in Young Children* (Snow, Burns, Griffin, 1998). These anchor studies are followed by discussions of laboratory and classroom studies according to areas identified as early predictors of later reading achievement.

Findings from Anchor Research Studies

Chall (1967) was considered by many researchers as the authority on how children learn to read. She taught practitioners to look for the evidence. The question at the center of Chall's (1967) "Great Debate" review was "What does the evidence have to say about the effectiveness of direct instruction or explicit phonics compared to whole word instruction or implicit phonics?" Should beginning reading instruction focus on direct instruction of correspondences of letters and sounds? Chall's (1967) conclusion based on 22 programs, classroom observations, and reviews of published studies showed that students who received direct phonics instruction tended to have higher achievement in the first three grades than did the students who were in whole word classrooms. Whole word

classrooms did perform better on comprehension and reading rate initially; but, in later grades, the advantage of phonics became apparent in spelling, word recognition, and comprehension (Chall, 1967). Adams (1990) has also more recently reviewed the research literature that bears on the debate between direct explicit phonics and whole word reading in reading instruction. After examining the evidence, she drew strong conclusions and stated them boldly. Adams (1990) also argued that phonics approaches to teaching reading were more successful than non-phonics approaches. The findings from these meta-analyses of teaching reading have paved the way for further studies by the National Research Council (NRC) and National Reading Panel (NRP).

The National Research Council (1998) revisited these findings of the meta-analysis in a new light of inquiry directed at reducing children's reading difficulties in their report *Preventing Reading Difficulties in Young Children* (Snow, Burns, Griffin, 1998). The council reviewed research on early childhood as well as reviewing the problems of teacher preparation in the foundations of reading. The report's attention to language and literacy experiences *before* a child enters school and importance of decoding knowledge in beginning reading instruction creates a critical pairing for effective beginnings. Schools should look to research and make sure that children acquire the ability to decode words and have practice reading to gain reading fluency (Snow, Burns, Griffin, 1998).

The National Reading Panel (2000) examined applying reading research to classroom practice. Topics of interest in this report were phonological awareness, phonics, fluency, comprehension, teacher preparation, and the use of computer technology in the classroom. The meta-analysis based on available data on these topics is valuable in its findings concerning phonological awareness and phonics. The committee

found that in some areas there was not enough good quality research to make valid conclusions. The report noted a strong empirical base to support the importance of instruction in phonological awareness along with phonics instruction in beginning reading instruction (National Reading Panel Report, 2000). This literature review now moves to specific areas of research that impact early identification and preventive intervention beginning with the two approaches from Chall's (1967) "great debate".

Two Approaches to Reading Instruction

Several theories concerning effective ways to teach reading have evolved throughout the ages. These theories come and go in popularity with some having greater success than others. Two approaches that led the "reading wars" during the last decades are of particular interest in this study, as are the theories which support them. The two approaches are the top-down approach and the bottom-up approach to teaching reading.

The whole-language approach is considered a top-down approach and is grounded in constructivist learning theory due to its heavy emphasis on interaction. Pioneers of the whole-language approach, Ken Goodman and Frank Smith, believed that language in authentic situations benefited students through building on prior knowledge they have. Goodman (2005) believed that children have a curiosity about the world around them and would naturally set out to make sense of it. Smith (2004) added to that belief that "reading is the most natural activity in the world" (p. 2). The whole-language approach is considered a whole-to-part model of instruction, marking it as a top-down approach to reading (Goodman, 2005). Goodman presumed that it was unnecessary to teach decoding skills and that by breaking whole (natural) language into bite-size abstract little pieces, the text was turned into an abstraction that was unrelated to meaning and experiences (2005). Goodman

maintained that instruction in decoding may distort or possibly impede literacy acquisition (2005). Sounding out an unknown word would be considered a strategy of last resort with little guidance given to students on how to do this. Smith promoted the idea that the best strategy for determining the identity of meaning for unfamiliar words was from context (2004). He surmised that the focus should be on the meaning of what the students read rather than laboriously sounding out the individual words. Smith's (2004) belief that "learning to read is not rocket science" (p.3), led to much controversy in the field following its publication.

In *Teaching Reading IS Rocket Science*, Moats (1999), took a position contrary to Smith's view claiming that teaching reading is a job for an expert and IS indeed rocket science. Moats (1999) proposed "learning to read is not natural or easy for most children. Reading is an acquired skill" (p.16) and does require direct instruction as prescribed by the bottom-up theory of reading instruction. The bottom-up approach leans heavily on direct literacy instruction. The bottom-up approach is based in behaviorism and is led by Gough (1986), who maintained that "the ability to decode is at the core of reading ability, such that learning to decode is tantamount to learning to read" (p. 1). The bottom-up approach treats emerging reading skills as a sequential progression. Gough (1986) believed that "word recognition skill (in an alphabetic orthography) is fundamentally dependent upon knowledge of letter-sound correspondence rules" (p.7). In this approach students must first learn the basics of phonological awareness, phonics, and how to decode words by applying alphabetic principle before more complex skills such as reading comprehension can be mastered.

Phonological Awareness

Since the early 1970s, researchers studying phonological awareness have used more than twenty different tasks to measure awareness of phonemes in words. These phoneme awareness measures are often grouped into three categories: sound comprehension, phoneme segmentation, and phoneme blending (Torgesen, 1998). Although the different kinds of phonemic tasks all appear to measure the same ability, at certain ages there may be some differences between segmentation and blending (Wagner, Torgesen, & Rashotte, 1994). Blending and segmenting are the core concepts of phonemic awareness and are essential in decoding and encoding. Explicit instruction, which includes drawing a student's attention to phonological structures within spoken language and to connections between phonemes and spelling, supports students who have not yet mastered the understanding of the relation between spoken phonemes and letters in written words (Snow, Burns, Griffin, 1998).

Using fluency as a predictor of reading achievement is usually assessed in a one-minute timed test of a reading passage. Words per minute are recorded and errors are subtracted for a "correct words read per minute" score. The fluency with which students translate text into spoken words in reading should be an indicator of word recognition skill as well as indication of the student's comprehension of the text (Fuchs, Fuchs, Hosp, & Jenkins, 2001).

Predictors of Reading Achievement

Researchers from the National Research Council have examined a number of factors to determine whether there is a connection between each factor and later reading achievement. Factors include those identified in the household, neighborhood, and

community. Family history of reading difficulties, home literacy environment, opportunities for verbal interactions, and socioeconomic status are a few of the family-based risk factors that have been considered for predictors of reading achievement. Child-based risk factors include hearing impairment, visual impairment, early language impairment, and attention deficits (Snow, Burns, Griffin, 1998).

Predictors at school entry include acquired proficiency in language, verbal memory, phonological awareness, reading readiness, letter identification, concepts of print, verbal IQ, and naming skills (Snow, Burns, Griffin, 1998). These school entry predictors are critical for early identification and preventive interventions and will prove essential to the underpinnings of this study. This study seeks to increase the knowledge base around cognitive abilities as long term predictors of reading fluency.

Distinguishing predictors from causes or explanations of difficulty in reading are critical. Predictors are simply correlates. Predictors should not be interpreted as the inevitability of poor reading achievement nor causes for reading problems. However, the fact that the characteristics correlate with subsequent reading achievement is advantageous for identifying students with the greatest need for intervention. The National Research Council also highlights that "relationships between effective predictors and reading difficulties are markers only and that other mediation variables, which are not measured in a particular research study, may also correlate with reading difficulties" (Snow, Burns, Griffin, 1998).

Screening for Early Identification

Our best possible solution to reading failure is through preventive intervention which requires early identification. The goal is to help educators identify struggling

readers early before the students experience serious failure (Torgesen, 1998). These are students who may need additional instruction in reading through early grades of elementary school to not fall behind in their reading skills. Research has shown that the rapid growth of the brain and its response to instruction in the primary years make the time from birth to age eight a critical period for literacy development (Nevills & Wolfe, 2009); therefore, it is essential to identify struggling readers as soon as possible.

The efficacy of the preventive intervention will be improved if procedures are used to accurately target the right children early in the process of reading instruction. The role universal screeners play in the process of early identification of at-risk students is essential to the success of preventive intervention. The RTI² Framework of Tennessee (2013), as well as the Say Dyslexia legislation, suggests that it is crucial to screen all students K-8 in reading. Screening measures are brief assessments of a skill or ability, usually one that is highly predictive of a later outcome. Screening measures are used to quickly identify those who need intervention and those who do not. According to the RTI² Framework (2013), it is crucial for ALL students to be screened. Universal screening results should identify students at risk for reading failure. A screening instrument needs to be quick and easy to administer. These screeners should include key domains that are identified as predictors of reading abilities in the future.

According to research, kindergarten screening measures that are most successful include phonological awareness activities such as phoneme segmentation, blending, rhyming, letter naming fluency, letter-sound correspondence fluency, phonological memory in the form of non-word repetition (Catts, Nielsen, Bridges, Liu, Bontempo, 2015; Jenkins & Johnson, 2008). Aimsweb, DIBELS, Easy CBM are universal screeners

which have subtests for letter naming fluency, letter-sound correspondence fluency, and phoneme segmentation fluency, but do not assess blending, rhyming, or phonological memory.

Studies show that measures for first grade that are most successful include phonemic awareness, especially phoneme segmentation fluency, blending, and manipulation tasks, letter naming fluency, letter-sound identification, phonological memory such as non-word repetition, vocabulary, and word identification fluency (Jenkins & Johnson, 2008). Most reading universal screening instruments also assess oral reading beginning at mid-year for first-grade students. For first grade Aimsweb, DIBELS, and Easy CBM have subtest for phoneme segmentation fluency, letter naming fluency, letter-sound fluency, and oral reading fluency, but do not assess phonemic awareness tasks of blending, phoneme manipulation, and phonological memory.

Early Identification

Early Preventive Intervention is specialized instruction specifically designed to target skill deficits and provide appropriate instruction to meet the needs of students based on early identification. The definition of early intervention in the RTI² Framework (2013) notes that "intervention is provided early in order to prevent future learning disabilities or present academic performance deficits with the goal of maintaining grade-level or above grade-level performance" (p.112).

Universal screeners are typically administered three times per year in kindergarten and first grade in an effort to provide early identification of at-risk students in reading. Realizing that instruction in phonological awareness during kindergarten can have a positive effect on reading growth after formal reading instruction begins in first grade,

preventive intervention models attempt to identify at-risk students at some point during kindergarten so that preventative measures can start as soon as possible (Lundberg, Frost, & Peterson, 1988).

It takes four times as long to intervene with a fourth-grade student as it does with a student in late kindergarten (Lyon & Fletcher, 2001). Struggling readers who are not identified early and do not receive early intervention tend to fall further and further behind in school (Stanovich, 1986)

Elements of an Effective Preventive Intervention

"The best solution to the problem of reading failure is to allocate resources for early identification and prevention" (Torgesen, 1998, p.1). Critical elements of a preventative reading model at the elementary school level are that the right kind and quality of instruction is delivered at right level of intensity and duration to the right students at the right time. The right kind and quality of intervention includes instruction that is explicit, systematic, and structured (Torgesen 1998). For these at-risk students, this type of instruction is not just beneficial, but is absolutely necessary for becoming proficient readers (Moats, 1998). We cannot just assume that these at-risk students will just absorb these necessary skills of reading by being exposed to books and being read to aloud (Torgesen, 2005). Many popularly employed reading approaches are not effective for struggling readers because they do not focus on the decoding skills struggling readers need to succeed. One more effective approach recommended for struggling students is an approach called Structured Literacy which is outlined by the International Dyslexia Association in 2016. This approach prepares students to decode words in an explicit and systematic way.

Structured Literacy

Evidence-Based Elements

Structured Literacy explicitly teaches systematic word identification and decoding strategies that are vital for success in learning to read. Structured Literacy is a more effective approach to reading than Guided Reading or Balanced Literacy when working with students who have dyslexia or others who have phonological deficits, but there is also substantial evidence that it is more effective for ALL students. Structured literacy instruction is marked by several elements.

Phonology, the study of the sound structure of spoken words, is a key element to Structured Literacy instruction. Phonological awareness includes rhyming, counting words in a spoken sentence, and clapping syllables. Phonemic awareness, ability to segment words in to their component sounds or phonemes, is an important aspect of phonological awareness and is a strong predictor of later reading ability.

Sound-Symbol Association, the mapping of phonemes, or sounds, to graphemes, or letters is also a key element. Once students have developed the awareness of phonemes of spoken language, they must then learn to map the phonemes to symbols or printed letters. Sound symbol association must be taught and mastered in two directions: visual to auditory in reading and auditory to visual in spelling. Students must also master the blending of sounds into words and be able to segment whole words into individual sounds.

Syllables instruction involves an understanding of the six syllable types. A syllable is a unit of oral or written language that contains one vowel sound. Syllable instruction includes explicit instruction on the six syllable types in the English language: closed syllables, vowel-consonant –e syllables, open syllables, Consonant-le syllables, r-controlled syllables, and vowel team syllables. Knowledge of syllables is not only an important organizing idea, but by knowing the syllable type, the reader can determine the appropriate sound for the vowel in that particular syllable. Instruction in syllable division rules provides strategies for struggling students to tackle multisyllabic words.

Morphology, the study of the smallest unit of meaning in language, helps readers decode and unlock meaning of complex words through the study of base words, roots, prefixes, and suffixes. Syntax dictates the sequences and function of words in a sentence, and helps readers understand grammar, sentence variation, and the mechanics of language. Semantics is an aspect of language that is concerned with meaning.

Summary

A single study's findings are not sufficient to generalize to other populations, but an accumulation of high-quality research across similar topics help verify the accuracy of the findings and, in turn, should increase our confidence in those findings (Lyon & Chhabra, 2004). The National Reading Panel (NRP) found that systemic phonics instruction led to significant gains for K-6 students and for struggling readers (2000). The National Research Council (NRC) concluded that students are more prepared to read when they have acquired language skills before kindergarten and direct instruction of phonological awareness and phonics after entering school. The findings of the NRC and NRP reports support the need for direct decoding instruction as did the meta-analyses of

Chall (1967) and later Adams (1990). Torgesen (1998) found that "letter name knowledge is a more sensitive predictor for kindergarten children and letter sound knowledge is a better predictor for children in first grade" (p.6). Explicit instruction in phonological structures within spoken language and to connections between phonemes and spelling supports students who have not yet mastered the understanding of the relation between spoken phonemes and letters (Snow, Burns, Griffin, 1998). All of these findings support the fact that teachers should look to the research for guidance on best practices for teaching reading.

CHAPTER III: METHODOLOGY

Introduction

The insights from the anchor studies, meta-analyses, classroom studies on predictors of fluent reading, coupled with the research on early identification and preventive intervention, paved the way for this study, which examines phoneme segmentation fluency, letter naming fluency, and letter sounds fluency as predictors for later reading fluency. This study specifically examines the universal subtests given on the universal screening assessment for reading for the purpose of early identification to allow preventive intervention as described by Torgesen (1998) and discussed in the literature review chapter. In this chapter the plan for organizing the components and the methodology needed to conduct this quantitative study are outlined. This study considered student data sets of kindergarten LNF, LSF, PSF as independent variables to determine the presence of correlations to third grade oral reading fluency as a dependent variable for the purpose of early identification and preventive intervention.

Restatement of Questions & Purpose

As described in Chapter 1, the purpose of this study was to determine if the foundational skills subtests assessed at the end of kindergarten on the universal screener were predictors of the subtest of fluency which was assessed three years later. Previous research has shown that different combinations of subtests prove to be more effective predictors than any one single subtest. Research also indicates that although phonological awareness is a strong single predictor of later reading fluency, it is not usually used in the combinations from prior research. Therefore, the potential contribution to prediction, when combined with other variables, remains unknown, and the optimal combination of

predictive skills has not yet been identified and may provide new findings in the gap. This study first sought to determine if there was a correlation between the subtests of the universal screener and oral reading fluency and which subtest was the best single predictor of reading fluency in third grade. The study next sought to determine which subtests of the universal screener at the end of kindergarten were the optimal combination of predictive skills for reading fluency in third grade. This chapter describes the methods and procedures employed to provide insight into the correlation of subtests of reading as a predictor of later reading fluency. The purpose, research questions, context, methodology, and theoretical framework are presented in this chapter. Additionally, the chapter will discuss the data collection process, as well as the data analysis of the information attained.

The study involved quantitative research and addressed two research questions.

Research Question 1: Which single subtest of the universal screener: Letter naming, Letter sound, and Phoneme segmentation best predicts later reading fluency on the 3rd grade oral reading fluency subtest.

Research Question 2: Which combination of subtests of the universal screener best predict later reading fluency on the 3rd grade oral reading fluency subtest.

A quantitative approach was used to address the research questions using extant data from a universal screener data base. Pearson correlation and descriptive statistics were employed for Research Question 1(RQ1). For Research Question 2 (RQ2), multiple regression analysis was employed to identify which combination of the predictor variables of end of kindergarten LNF, LSF, or PSF were the most significant predictor of the outcome variable of 3rd grade Oral Reading Fluency for the same set of students three

years later. The goal was to produce a model that could predict outcomes for end of third grade from data at the end of kindergarten.

Research Setting/Context

Tennessee is divided into eight educational regions with each one containing a Center of Regional Excellence (CORE) office staffed with content specific academic consultants including an RTI Interventionist. The interventionists in each CORE office supports between 15 and 23 districts around the implementation of RTI².

The first layer of implementation in the RTI² Framework requires that all students are screened three times per year using a skills-based universal screener to determine areas of deficits in pre-reading and reading to identify struggling students. Support in districts often begins by collaborating with the district's supervisors to more closely analyze the universal screener data to identify trends and areas of need for support. A meeting was held in one district to discuss concerns from current data and identify possible support areas. Data revealed that large numbers of students in second grade would need Tier 2 and Tier 3 interventions. After considering the implications of this overabundance of students qualifying for RTI², the RTI Interventionist worked collaboratively with the principal to trace this particular set of second grade students back through previous years of universal screener data to where their struggles in reading appeared to begin. Most all of these students now needing RTI² had struggled since kindergarten. Universal screener data (common to all students) for this class of students from the end of their kindergarten year on subtests of Letter Naming Fluency (LNF) and Letter Sound Fluency (LSF) was analyzed. Findings concluded that 92% were not fluent in letter naming or letter sounds correspondence and struggled with alphabetic principle. After further analysis of other

subtest, the data also showed struggles for these students in phonological awareness areas as indicated by the Phoneme Segmentation Fluency (PSF) subtest of a common universal screener. These findings generated questions concerning non-mastery of these foundational areas of alphabetic principle and phonological awareness at the end of kindergarten and their possible correlation to non-mastery of reading fluency in third grade.

Another district had data that also appeared to show similar trends when small samplings of data were considered. Conversations with those district leaders prompted requests to be included in the study. This study contains data from those two districts.

Methodology

The site of this study is a rural southern region with data from two separate school districts in varying sizes from largest in the region to one of the smallest in the region. For the data sample, all students who were in kindergarten at the end of the 2015-16 school year and also in the district in third grade in 2018-19 in the two districts were selected for the study. The sample for the study consisted of approximately 616 sets of extant student data from these districts. Data consisted of archived student scores from a universal screener which was common to both districts. Student foundational literacy skills were measured at the end of kindergarten using the Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation. The Oral Reading Fluency subtest was used to measure reading achievement in third grade. The assessment was administered to the students and then scores entered into the data base for the universal screener prior to the study. The researcher requested two sets of data for each single student. Data consisted of universal screener scores from 2015-16 kindergarten students who took the assessment at

the end of the year. The end of year data for kindergarten consisted of Letter Naming Fluency, Letter Sound Fluency, Phoneme Segmentation, and Non-word Fluency. Next all 2018-19 third grade student scores from end of the year Oral Reading Fluency were selected by districts. Districts then compared names from the 2015-16 kindergarten and 2018-19 third grade sets of data to determine students who were enrolled in the district at the end of kindergarten in 2015-16 and were also enrolled in the district at the end of third grade in 2018-19. Only students who were common to both sets of data would be included in the study. Names were then removed from each report by the district before the data were compiled by the researcher.

Since the researcher was investigating the predictive nature of the early predictors of foundational reading for the purpose of early identification and preventive intervention, the data between 2016 and 2018 were not relevant to this study.

Once the student data was secured from the districts, it was entered into SPSS for statistical testing. A quantitative approach was used to address the research questions using extant data from the universal screener data base. Pearson correlation and descriptive statistics were employed for Research Question 1(RQ1). For Research Question 2 (RQI2), multiple regression was employed to identify which combination of the predictor variables of end of year kindergarten LNF, LSF, and PSF were the most significant predictor of the outcome variable of 3rd grade Oral Reading Fluency for the same set of students three years later to lead to a model that predicted outcomes.

Theoretical Framework

The theory used in this study is the bottom-up approach to reading instruction. The bottom-up approach is based in behaviorism and is led by Gough (1986), who maintained

that “the ability to decode is at the core of reading ability, such that learning to decode is tantamount to learning to read” (p. 1). The bottom-up approach treats developing reading skills as a sequential process. This theory recognizes reading as a developmental process that is best learned in a way that starts with a foundation and builds with complexity. As applied to this quantitative study, the bottom-up theory contends that one would expect the predictor variables of letter naming, letter sound, and phoneme segmentation to influence the outcome variable of later fluency as shown in this correlational study because the bottom-up theory says that reading is a skill in which students learn to read in a step-by-step way. Gough’s (1986) believed that “word recognition skill (in an alphabetic orthography) is fundamentally dependent upon knowledge of letter-sound correspondence rules” (p.7). In this approach, students must first learn the basics of phonological awareness, phonics, and how to decode words by applying alphabetic principle before more complex skills such as fluency and reading comprehension can be mastered. This study attempted to prove this theory by showing that Letter Naming Fluency and Letter Sound Fluency are early predictors of later reading fluency.

Participants & Data Sources

This study did not involve interaction with teachers or students. District leaders were requested to provide data with no identifying characteristics to insure anonymity. The archived student performance data consisted of universal screener scores of 2015-16 kindergarten students who took the assessment at the end of the year. The end of year data for kindergarten from the universal screener consisted of Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation. Next, all 2018-19 third grade student scores from end of the year Oral Reading Fluency were selected by districts.

Data Collection Procedures

Archived student universal screener data was collected from two school districts in Tennessee. This archived student performance data consisted of a common universal screener scores of 2015-16 kindergarten students who took the assessment at the end of the year. The end of year data for kindergarten from the universal screener consisted of Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation. Next all 2018-19 third grade student scores from end of the year Oral Reading Fluency were selected by districts. Districts then compared names from the 2015-16 kindergarten and 2018-19 third grade sets of data to determine students who were enrolled in the district at the end of kindergarten in 2015-16 and were also enrolled in the district at the end of third grade in 2018-19. Only students who were common to both sets of data would be included in the study. Names were then removed from each report by the district before the data were collected by the researcher.

Data Analysis Procedures

Once the student data was secured from the districts, it was entered into SPSS for statistical testing. A quantitative approach was used to address the research questions using extant data from the universal screener data base. Pearson correlation and descriptive statistics were employed for Research Question 1(RQ1) to determine which of the measures from the universal screener at the end of kindergarten were the best predictors of reading fluency at the end of third grade. For Research Question 2 (RQI2), multiple regression was used to determine what combination of the variables from all three measures at the end of year kindergarten LNF, LSF, PSF, NWF was the most

significant predictor of the outcome variable of 3rd grade Oral Reading Fluency for the same set of students three years later.

Summary

This chapter described the methods and procedures employed to provide insight into the correlation of subtests of reading as a predictor of later reading fluency. The purpose, research questions, context, methodology, and rationale were presented. Additionally, the chapter discussed the data collection process, as well as the data analysis of the information attained. In Chapter 4, the presentation of the findings will address the correlations found in response to each research question. A summary and discussion of the findings as they relate to implications will follow in Chapter 5.

CHAPTER IV: FINDINGS

Introduction

RTI² ensures that districts implement a universal screening process which includes multiple data sources to determine students' strengths and deficit areas and affords them accurate information for making informed decisions to address the needs for each student who may need additional support. The universal screening process includes the use of a skills-based universal screener. A skills-based universal screener is the most appropriate way to identify specific skills deficits and inform the need for skills-based interventions. In grades K-5 the universal screening process, using a skills-based universal screener, should be conducted three times per year (fall, winter, spring). Results from the universal screening process, along with other data points, can be used to determine the need for intervention. Therefore, districts screen kindergarten students each spring using Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation Fluency subtests on a skills-based universal screener. It is the scores from these subtests that were of interest to this study.

Outlined in this chapter are the quantitative results that address the research questions:

1. Which single subtest of the universal screener (Letter Naming Fluency, Letter Sound Fluency, or Phoneme Segmentation Fluency) best predicts later reading fluency on the 3rd grade Oral Reading Fluency subtest?

    Null Hypothesis: None of the subtests administered at the end of kindergarten from the universal screener (Letter Naming Fluency, Letter Sound Fluency nor Phoneme Segmentation Fluency) independently

show a statistically significant relationship to Oral Reading Fluency; therefore, there would be no reason to prefer one measure over the others as the best predictor.

Alternative Hypothesis: One or more of the subtests administered at the end of kindergarten from the universal screener (Letter Naming Fluency, Letter Sound Fluency, or Phoneme Segmentation Fluency) independently show a statistically significant relationship to Oral Reading Fluency with the highest *r*-value being the best predictor.

2. Does the combination of all three subtests (Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation Fluency) of the universal screener better predict later reading fluency on the 3rd grade Oral Reading Fluency subtest?

   Null Hypothesis: Combining the subtests (Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation Fluency) of the universal screener does not show a statistically significant relationship to reading fluency on the 3rd grade Oral Reading Fluency subtest.

   Alternative Hypothesis: Combining the subtests (Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation Fluency) of the universal screener shows a statistically significant relationship to reading fluency on the 3rd grade Oral Reading Fluency subtest?

It is beneficial to an understanding of the results of this quantitative study to have knowledge of what each subtest involves as well as how each is administered. This study examined the extent to which these kindergarten universal screener subtests influenced

later reading fluency, specifically at the end of third grade. Oral Reading Fluency administration and scoring for third grade will also be discussed.

Context

Letter Naming Fluency is a standardized test that is individually administered to provide a measure of risk. In the spring of the school year, kindergarten students are individually presented with a page of mixed upper-case and lower-case letters arranged in random order with ten letters per row. Students are asked to name as many letters as possible. If a student does not know a letter, the examiner provides the letter name after three seconds. The student is allowed one minute to produce as many letters as possible. The score is the number of letters correctly named in one minute.

Letter-Sound Fluency is a subtest of the universal screener which is also given to kindergarten students in the spring. Letter-Sound Fluency is administered individually to provide a measure of risk. Students are presented with a page of lower-case letters with ten letters per row. Students are asked to tell the sound of as many letters as they can. If the student does not know a letter sound, the examiner tells the student the letter sound after three seconds. The student is allowed one minute to produce as many letter sounds as possible and their score is the number of correct letter sounds given in one minute.

Phoneme Segmentation Fluency is a standardized test of phonological awareness that is also administered individually in the spring. This measure assesses the kindergarten student's ability to segment three or four phoneme words into their individual phonemes fluently. In the Phoneme Segmentation Fluency task, the examiner orally presents the words containing three or four phonemes. The student is then to verbally produce the individual phonemes in each word. The student receives one point

for each phoneme correctly segmented. For example, if the examiner presented the word "cat" and the student replies "/c/ /a/ /t/" the student receives three points for that word and the examiner would present another word very quickly. This is repeated with like words for one minute, and the number of phonemes correct in one minute is the final score for this measure.

In third grade, students are screened using a skill-based universal screener for Oral Reading Fluency (ORF) in the spring. This measure is designed to be a quick check of how the student is progressing with fluency in reading. The Oral Reading Fluency measure is a standardized test that is individually administered for fluency with connected text as well as a measure to show accuracy when reading connected text. The passages are calibrated for each grade level. Students read a passage aloud for one minute. Misread words, omissions, substitutions, or hesitations of more than three seconds are marked as errors. If students self-correct, the words are scored as accurate. The number of words read correctly in one minute is the score for this measure.

Districts assign examiners who have been trained to administer the measures of the skill-based universal screeners. Districts have different processes for administering the universal screen measures and some screenings are done periodically over several days due to district preference. After students have been assessed, districts and schools enter the scores into the data system to archive student data. This screening process took place before this study began. Archived student performance data from the universal screener was requested by the researcher for student data sets including kindergarten scores at the end of the year 2015-16 for Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation Fluency and for those same students with third grade scores

for Oral Reading Fluency at the end of the year 2018-19. After all names were removed, these student data sets were provided to the researcher from the two districts. Original compilation of total students' scores were 802 student data sets. Due to absenteeism for sickness, transfers into and out of districts, and other unavoidable circumstances not all students were screened on all three subtests in kindergarten and some were not screened on Oral Reading Fluency in third grade. Only student data sets with all three kindergarten subtests (Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation Fluency) and third grade Oral Reading Fluency were included in the data set for this study since having different sample sizes for the variables would afford an unequal sample size for the correlation. Since regression would delete all observations with any missing data, it would create inconsistent results. Therefore, any student data sets missing one or more of the four of the universal screener measures were extracted from the student data set sample in an attempt to avoid inconsistent results in the study. After removing 186 incomplete student data sets, a total of 616 student data sets remained eligible for the study sample set.

Research Question 1

This section presents the quantitative results to address the research question: Which single subtests of the universal screener: Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation Fluency best predict later reading fluency on the 3rd grade Oral Reading Fluency subtest. A quantitative approach was used to address the research question using extant data from a universal screener data base provided to the researcher from two school districts. A correlational test was used to determine relationships among the variables taken from the data of the subtests from the universal

screener for Research Question 1. Pearson correlational tests was run to check whether there were any significant relationships between the subcomponents of the universal screener (Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation Fluency) in the spring of kindergarten and Oral Reading Fluency in the spring of third grade.

Descriptive statistics, including means and standard deviations of scores in the study sample, for each variable, are summarized in Table 2. Next, the means for each measure will be discussed in relation to means from the national norms table for the universal screener. The sample mean for kindergarten scores on Letter Naming Fluency was 57.67 which is higher than the national norm of 52. The sample mean for kindergarten scores on Letter Sound Fluency of 46.65 which is several points higher than the national norm of 39. The sample mean for kindergarten scores on Phoneme Segmentation Fluency is 49.45 which is still slightly higher than the national norm of 46 for this subtest. The sample mean of third grade scores on Oral Reading Fluency is 116.30 which is several points lower that than the national norm of 125 (n = 616).

Table 2

Descriptive Statistics and Correlations for Study Variables

Variable	*n*	*M*	*SD*	1	2	3	4
1. Letter Naming Fluency for K	616	57.67	16.447	—			
2. Letter Sound Fluency for K	616	46.45	15.964	.782**	—		
3. Phoneme Segmentation Fluency for K	616	49.45	14.688	.314**	.347**	—	
4. Oral Reading Fluency for 3rd	616	116.30	37.898	.600**	.561**	.218**	—

The kindergarten subtests listed in RQ1 all have statistically significant relationships, as shown in Table 2, and there is a larger relationship between letter naming fluency and letter sound fluency with a coefficient (*r*) of .782, while a coefficient (*r*) of .314 shows that there is a smaller relationship between letter naming fluency and phoneme segmentation fluency. ($p = <.01$)

In view of RQ1, the relationships between 3rd grade oral reading fluency and kindergarten scores from subtests, phoneme segmentation fluency and oral reading fluency have a statistically significant relationship with an *r* of .218 ($p = <.01$). Although it is also noted, that there is a larger relationship between 3rd grade oral reading fluency and letter sound fluency ($r = .561$) ($p = <.01$), as well as, 3rd grade oral reading fluency and kindergarten letter naming fluency ($r = .600$) ($p = <.01$).

The findings from this correlation analysis indicate the need to reject the null hypothesis that none of the subtests administered at the end of kindergarten from the universal screener (Letter Naming Fluency, Letter Sound Fluency nor Phoneme

Segmentation Fluency), when considered independently, showed a statistically significant relationship to Oral Reading Fluency. The alternative hypothesis that one or more were correlated with Oral Reading Fluency at the end of third grade is accepted. As indicated in the discussion on the correlation matrix, all three of the subtests of Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation Fluency at the end of kindergarten showed to be statistically significant relationship to Oral Reading Fluency at the end of third grade.

Research Question 2

This section presents the quantitative results to address the research question: Which combination of subtests (Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation Fluency) of the universal screener best predicts later reading fluency on the 3rd grade oral reading fluency subtest?

Multiple regression analysis is a general statistical technique used to analyze relationships between a single outcome variable (3^{rd} grade ORF) and several predictor variables (Kindergarten LNF, LSF, PSF). As discussed in Chapter 3, kindergarten predictor variables were selected for this study based on a sound theoretical rationale of Gough and the bottom-up approach to literacy instruction which posits that students must first learn the basics of phonological awareness, phonics, and how to decode words by applying alphabetic principle before more complex reading skills can be mastered (Gough & Tumner, 1986). Well-conducted past research as described in the literature review section have also demonstrated the importance of these variables when predicting oral fluency. The forced entry method used also relies on these strong theoretical reasons for including the chosen predictors which are forced into the model simultaneously.

The adjusted R^2 of .378 gives some idea of how well this model generalizes considering that its value is very close to the value of R^2 at .381 at 0.3%. This shrinkage means that if the model were derived from the general population rather than the sample it would account for approximately 0.3% less variance in the outcome.

Analysis of the ANOVA shows a significance level of less than .05 on the ANOVA Table 3, which indicates significance and promotes trust in the model. The ANOVA indicates that the model is a significant fit of the data overall and warrants proceeding to use the coefficients table. ($p = <.01$)

Table 3

ANOVA

	df	*ss*	*MS*	*F*	*P*
Regression	3	336941.952	112313.984	125.808	.000[b]
Residual	612	546356.276	892.739		
Total	615	883298.227			

a. Dependent Variable: Oral Reading

b. Predictors: (Constant), Phoneme Seg, Letter Name, Letter Sound

In checking for multicollinearity, a scan of the correlation matrix of the predictor variables in Table 3 indicates that none seem to correlate very highly, with no correlation of above .80 or .90 so using this scan approach, there appears to be no multicollinearity among the variables.

An alternate approach to determining possible multicollinearity is determining if the variance inflation factor (VIF) indicated whether a predictor has a strong linear

relationship with the other predictors. There are no strict and simple rules about the value pertaining to the VIF to cause concerns of multicollinearity. However, there are general guidelines:

1. The largest VIF, which indicates whether a predictor has a strong linear relationship with the other predictors, for this model is 2.654, which is less than the guidance, which indicates it would be cause for concern if the VIF is greater than 10.
2. The regression may be biased if the average VIF is substantially greater than the number 1. The average VIF for this model is 2.128667.
3. A potential problem exists if the tolerance statistic is below 0.2, which it is not, as the lowest tolerance statistic is .377. (Field, 2013.)

A degree of assurance for the model comes through checking for multicollinearity using both the scanning approach and the guidelines approach recommended by Field (2013). There appeared to be no multicollinearity; therefore, the use of the model moved forward.

Analysis of the unstandardized coefficients in Table 4 shows that an increase of one in Letter Naming Fluency causes the outcome variable to increase by .952 and is a fairly high impact compared to the Letter Sound Fluency which when increased by one increases the outcome variable by .560 and Phoneme Segmentation Fluency has a beta value of only .016. The standardized coefficients in Table 4 indicate the breakdown of which of these multiple variables has the largest impact and how much at the standard deviation level. One unit change in Letter Naming Fluency, or plus one in letter names, moves a standard deviation level of .41 and is significant. ($p = <.01$). The best fit using the model summary is to retain all three variables although removal of PSF would not

make the model substantially less predictive. To warrant a true picture of a student's mastery of foundational skills, a combination of alphabet knowledge and phonological awareness are essential and PSF should remain included. The regression line is a significant predictor of ORF, $F(3,612) = 125.81$, $p < .001$, $R^2 = .381$.

Table 4

Coefficients

	Unstandardized Coefficients		Standardized Coefficients			
	B	*SE B*	*B*	*T*	*p*	*VIF*
Constant	34.583	5.253		6.583	.000	
LNF	.952	.118	.413	8.079	.000	2.589
LSF	.560	.123	.236	4.552	.000	2.654
PSF	.016	.088	.006	.186	.853	1.143

A one unit increase in letter naming has a .41 positive improvement in Oral Reading Fluency scores and is huge. This multiple regression analysis was used to analyze the relationship between a single dependent variable, Oral Reading Fluency, and several independent variables including Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation Fluency. Letter Naming Fluency and Letter Sound Fluency at the end of kindergarten and Oral Reading Fluency at the end of third grade showed a strong statically significant relationship.

Summary

To summarize, using correlational analysis for RQ1 to determine which single subtests of the universal screener best predict later reading fluency on the 3rd grade Oral Reading Fluency subtest showed that while Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation Fluency, had a statistically significant relationship, the strongest relation to later reading fluency of these kindergarten measures to be Letter Naming Fluency. It is important to note that all three subtests showed statistically significant relationships to later oral reading fluency.

For RQ2 to determine if a combination of subtests of the universal screener measures at the end of kindergarten would best predict later reading fluency on the 3rd grade oral reading fluency subtest, a multiple regression analysis was used to fit a linear model to the data from the sample population and was used to predict values of dependent variable of Oral Reading Fluency at the end of third grade. The multiple regression model which considered a combination of three subtests from the end of kindergarten is more predictive than the single subtests predictors and the linear regression line is a significant predictor of oral reading fluency in third grade. This tool is exceedingly useful and will permit the researcher to go a step beyond the data collected for the sample population in Chapter 5.

CHAPTER V: RESULTS

Introduction

Our nation is currently experiencing a national reading crisis, and, in response, Tennessee has new ideas and plans for improving early literacy in our state. In Tennessee the cognitive science research is making its way into many schools and schools of education and is a driving force in this new plan for early literacy. The department of education in Tennessee is proposing major legislation that will require all K-3 educators to be trained in evidence-based reading instruction because they now believe that early literacy is a critical foundation for life-long learning and must be a top priority. The bill was filed days before Governor Bill Lee delivered his State of the State address where he commented that he was setting aside about $70 million in his fiscal 2021 budget for early literacy support. The work from this study lies nestled under the fourth area in the Tennessee Early Literacy Supports Framework as listed below.

The Tennessee Early Literacy Supports Framework focuses on five areas:

1. High-quality instructional materials (foundational skills and knowledge building)

2. Teachers trained and certified in "science of reading" and implementation of "science of reading"

3. Vendor-based coaching supports that support teachers and school leaders in implementing materials effectively

4. K-2 diagnostic data tracking of student growth and mastery of foundational skills and comprehension

5. Family engagement resources to ensure families are equipped to be partners in early literacy

Early identification and preventive intervention are a part of the science of reading and are crucial for the prevention of reading disabilities within the RTI² framework. The results from this study indicate that a universal screening process, ensured by the RTI² framework, contains skills-based universal screeners that contain subtests of Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation Fluency that administered at the end of kindergarten, accurately predicted Oral Reading Fluency at the end of third grade.

Summary of Study

The purpose of this study was to determine if the foundational skills subtests on the universal screener assessed at the end of kindergarten (Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation Fluency) were predictors of the fluency measure (Oral Reading Fluency) which was assessed three years later. Previous research has shown that different combinations of Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation Fluency prove to be more effective predictors than any one single component. This study first sought to determine if there is a correlation between the subtests of the universal screener and oral reading fluency and which subtest is the best single predictor of reading fluency in third grade. The study next sought to determine the optimal combination of subtest for predicting reading fluency in third grade.

The purpose of this study was also to add to the body of knowledge and understanding around the use of foundational skills mastery as a predictor of later reading fluency. Specifically, the study sought to find the answers to the following research questions:

1. Which single subtest of the universal screener (Letter Naming Fluency, Letter Sound Fluency, or Phoneme Segmentation Fluency) best predict later reading fluency on the 3rd grade Oral Reading Fluency subtest?

    Null Hypothesis: None of the subtests administered at the end of kindergarten from the universal screener (Letter Naming Fluency, Letter Sound Fluency nor Phoneme Segmentation Fluency) independently show a statistically significant relationship to Oral Reading Fluency.

    Alternative Hypothesis: One of the subtests administered at the end of kindergarten from the universal screener (Letter Naming Fluency, Letter

Sound Fluency nor Phoneme Segmentation Fluency) independently shows a statistically significant relationship to Oral Reading Fluency.

2. Does the combination of all three subtests (Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation Fluency) of the universal screener better predict later reading fluency on the 3rd grade Oral Reading Fluency subtest than any one subtest?

   Null Hypothesis: Combining the subtests (Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation Fluency) of the universal screener does not show a statistically significant relationship to reading fluency on the 3rd grade Oral Reading Fluency subtest.

   Alternative Hypothesis: Combining the subtests (Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation Fluency) of the universal screener shows a statistically significant relationship to reading fluency on the 3rd grade Oral Reading Fluency subtest that is stronger than the relationship between any one test and Oral Reading Fluency.

Summary of Findings

The universal screening process included in the RTI² Framework of Tennessee includes the use of a skills-based universal screener. A skills-based universal screener is the most appropriate way to identify specific skills deficits and inform the need for skills-based interventions. In grades K-5 the universal screening process (using a skills-based universal screener followed by a diagnostic) should be conducted three times per year (fall, winter, spring). Results from the universal screening process, along with other data

points, can be used to determine the need for intervention. Therefore to comply with RTI² guidelines, districts screen kindergarten students each spring using Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation Fluency subtests on a skills-based universal screener. It is the scores from these subtests that are of interest to this study. This study examined the extent to which these kindergarten universal screener subtests may predict later reading fluency, specifically at the end of third grade.

Research Question 1

Among the subtests of the skills based universal screener, the Letter Naming Fluency measure of letter knowledge proved to be the strongest single predictor of later reading fluency. Letter Naming Fluency had a slightly stronger correlation with third grade Oral Reading Fluency (r=.600) than Letter Sound Fluency (r=.561). Phoneme Segmentation Fluency was also found to be statistically significant, but had a somewhat weaker correlation to later oral reading fluency (r=.218) than Letter Naming Fluency or Letter Sound Fluency. It is important to point out that all three predictor variables (LNF, LSF, and PSF) were statistically significant in their relationship to the outcome variable of ORF. Therefore, the null hypothesis is rejected based on these findings. When considering the subtests of the skills based universal screener (Letter naming Fluency, Letter Sound Fluency, and Phoneme Segmentation) at the end of kindergarten as single predictors of Oral Reading Fluency at the end of third grade, data confirms that Letter Naming Fluency and Letter Sounds Fluency are both strong single indicators of later reading fluency. Different studies in these three areas, indicated in Table 5, show various levels of correlation to later oral reading fluency. Many schools in Tennessee currently use Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation in the

universal screening process for Response to Instruction and Intervention and the results from this study support this practice by indicating that all variables have a statistically significant relationship to Oral Reading Fluency.

Table 5

Studies from lead researchers on predictors

Name	Date	Study Indicators		
		Letter Naming Fluency	Letter Sound Fluency	Phonological Awareness
Ball & Blachman,	1991	X	X	X
Bryant, MacLean, Bradley	1990			X
Chall	1983	X	X	
Drouin, Horner, Sondergeld	2012	X	X	
Hecht, Burgess, Torgesen, Wagner & Rashotte	2000	X	X	X
Kirby, Parilla, Pffieffer	2003			X
Muter, Snowling, Stevenson	2004			X

Scarborough Scarborough	1991 1998	 X	 X	X
Storch & Whitehurst	2002			X
Stuart	1995	X	X	X

Research Question 2

In the data set for this study, Letter Naming Fluency and Letter Sound Fluency tested at the end of kindergarten and Oral Reading Fluency tested at the end of third grade showed a strong statistically significant relationship. The null hypothesis is rejected due to the strong predictor line of the combined measures from kindergarten. A combination of measures from the skills-based universal screener assessed at the end of kindergarten are strongly correlated and predictive of Oral Reading Fluency at the end of third grade. This is the combination used by many schools in Tennessee as part of the universal screening process. The findings from this study support this practice.

Recommendations

Although many schools administer the skills-based universal screener to kindergarten students three times per year, many of those in practice indicate that they do not analyze the data and begin preventive interventions as soon as a deficit in letter knowledge is determined. Many educators and school literacy leaders prefer to disregard interventions until the second semester of kindergarten. This propensity to delay

interventions is often spurred by the belief that kids just need more time to mature and they will naturally read when they are ready, just as they learned to talk. However, educators cannot assume that these at-risk students will just absorb these necessary skills of reading by being exposed to books and being read to aloud (Torgesen, 2005). This study provides important evidence suggesting that these interventions may need to be used more actively. Understanding that Letter Naming Fluency and Letter Sound Fluency are predictive of later reading fluency should prompt school leaders to put in place interventions that begin as soon as letter sound correspondence has been taught in Tier 1 instruction (core reading) and students not at mastery have been identified. Science of reading researchers find this delay of instruction particularly distressing. They now recognize that the majority of students *can* learn to read if their reading instruction is based on science of reading evidence, early identification, and preventive interventions (Lyon, 2002; Moats, 1999; Shaywitz, 2003). The study shows through the correlative relationship that students who leave kindergarten struggling with letter-sound correspondence (identified through letter naming and letter sound screeners) will likely continue to read below grade level even in third grade unless an effective intervention is implemented.

Implications

Although correlation does not imply causation, educators can draw implications from this study in the areas of theory, practice, and policy. Knowing how strongly the pairs of variables are linearly related and how they change together does give insight into these three areas.

Implications for Theory

Results from this study support not only early identification, but also preventive intervention. In RTI², it is important to correctly identify students who need support and the level of support that is appropriate. The earlier struggling students are identified, the earlier preventive interventions may be implemented. Early identification of reading difficulties is advantageous because it enables preventive intervention and softening or possible prevention of reading difficulties. Moats (2017) and Torgesen (2004) agree that preventive intervention in kindergarten and first grade is more effective than waiting until students fall far behind. Torgesen (1998) encourages educators to "catch them before they fall."

Early intervention is critical and having predictive measures in the skills-based universal screener [involved in the universal screening process] allows educators to make data-informed decisions that ultimately should lead to improve student reading achievement outcomes. For RTI² to be successful, educators must rely heavily on all available data in the universal screening process to make early identifications of students at risk of reading difficulties and implement preventive interventions in a more timely manner to prevent reading failure in young children.

Findings from this study, showing the correlation between letter-sound correlation (LNF/ LSF) and phonological awareness (PSF) and later reading fluency (ORF), support the need for a preventive model of reading intervention. It is critical to understand the importance of why these interventions need to happen as soon as possible. Results to this struggling beginning in reading accrue dramatically over time.

Our best possible solution to reading failure is through preventive intervention which includes early identification and prevention. The goal is to help educators identify

struggling readers early before the students experience serious failure. These are students who may need additional instruction in reading through early grades of elementary school to not fall behind in their reading skills.

Research has shown that the rapid growth of the brain and its response to instruction in the primary years make the time from birth to age eight a critical period for literacy development; therefore, it is essential to identify struggling readers as soon as possible (Nevills & Wolfe, 2009). It is imperative to "catch them before they fall" (Torgesen, 1998). The findings from this study encourage educators to intervene early, before the deficits impede a reader's ability at a debilitating level, by screening kindergartners to discover deficits in letter sound correspondence fluency.

Implications for Practice

The statistically significant relationship between Phoneme Segmentation Fluency at the end of kindergarten and Oral Reading Fluency at the end of third grade on the skills-based universal screener suggest a need for intervention in phonological awareness during kindergarten. Phonological awareness is the metacognitive understanding that words have internal phonological structure. For students to be able to read they must bridge the gap between spoken and written language.

Deficits in phonological awareness is one of the characteristics of dyslexia noted by the International Dyslexia Association. Students with dyslexia have difficulty learning how the printed word maps onto the spoken language. It is suspected that a functional deficit in the brain circuits that support linguistic processing could be to blame. Through fMRI, functional magnetic resonance imaging, researchers can see the blood flow in the brain to detect areas of activity. Yet these functional imaging methods lack the needed resolution to show the sequence of regional activation in real time. Therefore, more recent studies have examined children with dyslexia using magnetoencephalography or magnetic source imaging (MSI) which allows tracking of brain activity in real time. Studies show that the vast majority of struggling readers who were engaging in a reading tasks exhibited a distinct brain activation profile that is uncommon among students who never experienced difficulty in reading. (Papanicolaou et al., 2007) Individual differences in the degree of specialization of the left temporoparietal region can impact mastery of alphabetic knowledge. Another conclusion from the study found that "systematic reading instruction that promotes the development of phonological awareness and decoding skills can drastically alter the aberrant activation profile found in children with dyslexia and

those at-risk of reading difficulties" (Papanicolaou et al., 2007, p. 16). This implies that instruction plays a critical role in establishing the brain mechanisms that are required for proficient reading. These findings are consistent with the current cognitive models for reading acquisition and the critical role of letter-sound correspondence in learning to read. Amazingly, evidence from that study suggests neural systems are altered when successful interventions occur. That particular study also suggests that instruction is sufficient to promote development of a normal brain circuit that supports reading. Their preliminary data also indicate that brain activation profiles associated with poor reading are malleable and change with instruction. This may indicate that instruction plays a significant role in the development of neural systems that are specialized for reading. (Papanicolaou et al., 2007). Conclusions from their study suggest that the deficit in functional brain organization underlying dyslexia can be reversed after two months of intense interventions showing that reading difficulties in many children represent a variation of normal development that can be altered by intensive intervention. Effective instruction appeared to change the brain in ways that are requisite to support learning to read. If educators can use early identification and put these preventive interventions in place, the results may be phenomenal!

Implications for Policy

The Say Dyslexia Law requires that students are assessed through RTI² screening process for letter-sound correspondence and phonological awareness. The link to the fMRI study of Papanicolaou and the malleability of the brain in kindergarten may make early screeners during kindergarten even more important.

Tennessee's Early Literacy Supports Framework is based on the "science of reading" and emphasizes 1) sounds-first phonics instruction, 2) systematic and explicit development of building sound patterns, 3) building students' ability to learn codes of letter patterns to sound patterns, and 4) the absence of "cueing" or "guessing" when decoding text. The science of reading is based on the simple view of reading, designed by Philip B. Gough and William E. Tunmer in 1986. The Early Literacy Support Framework aligns its priorities to this research and includes in the five areas of focus the need for K-2 diagnostic data tracking of student growth and mastery of foundational skills. This tracking of students will open the door for studies such as this current study for districts to be able to see with their own data the correlation of letter-sound correspondence and later oral reading fluency and use similar correlation studies to track students across years.

The efficacy of the preventive reading intervention will be improved if procedures are used to accurately target the right children early in the process of reading instruction. The role universal screeners play in the process of early identification of at-risk students is essential to the success of preventive interventions. It takes four times as long to intervene with a fourth-grade student as it does with a student in late kindergarten (Lyon & Fletcher 2001). Struggling readers who are not identified early and do not receive early intervention tend to fall further and further behind in school (Stanovich, 1986). Findings from this study support the literature in that, if students struggle on early foundational skills on the skills based universal screener at the end of kindergarten, they typically continue to struggle at the end of third grade in reading fluency.

The most critical elements of a preventive intervention at the early elementary school level are that the right kind and quality of instruction is delivered at right level of intensity and duration to the right students at the right time. The right kind and quality of instruction is explicit, systematic, and structured. For these at-risk students this type of instruction is not just beneficial, but is absolutely necessary for becoming proficient readers. We cannot assume that these at-risk students will just absorb these necessary skills of reading by being exposed to books and being read to aloud (Torgesen, 2005). Popularly employed reading approaches are not effective for struggling readers because they do not focus on the decoding skills struggling readers need to succeed. One approach recommended for struggling students is an approach called Structured Literacy. This approach prepares students to decode words in an explicit and systematic way. The study shows the relationship of fluency in letter-sound correspondence and oral reading fluency and supports the literature around Structured Literacy.

Knowing the correlation between alphabetic principle and later reading fluency creates a need for urgency around mastery of early foundational literacy skills. Organizations and government bodies who work to educate young children need to promote public understanding around what early literacy looks like and how it develops. Parents, daycare workers, preschool teachers, and other caregivers should be the target for these campaigns which should emphasize ways of using books and opportunities for building language and literacy growth both at home and in group care settings through routine daily activities. Research affords abundant evidence of the significance of nurturing cognitive, language, and social development during children's early years. All

young children, particularly those at risk for reading difficulties, should have access to early childhood settings that stimulate language and literacy growth.

Limitations and Delimitations

The relationship between the foundational skills and later reading fluency cannot be perceived as causal in nature and may be seen as a limitation for this study since the findings will not prove that mastery of foundation skills are the cause for later fluency. One limitation that has potential for impacting results is that interventions between kindergarten and third grade are not documented or considered for this study.

Another limitation of this design is that in working to protect the anonymity of participants, the researcher was not able to collect data about teachers and their relative experience as it relates to student performances in this study. This is an area in which data might be disaggregated in the future and specific consideration of training and experience of teachers would be considered as another co-variate.

The next limitation is that the fidelity of the administration on the universal screener cannot be guaranteed. Since this data is taken from an existing data base, there is no way to ensure that the screener was administered in the way it was intended. Another limitation would be student variance on any one given test day. Factors such as a child's health, life events from prior in the day to testing, vision problems, and/or hearing problems may all affect universal screener results.

Due to the magnitude of this study, there are several delimitations to the study that may have an impact on the results and findings. Delimitations for the study include the limit of the scope to scores at the end of kindergarten and the end of third grade and not

including the years between the two. Entering data for 616 students for four years would be an undertaking for a research team rather than one researcher. Another delimitation would concern the role that teachers and interventions play in bringing students to read fluently and the impact that certain teachers and curriculum could have on results.

Suggestions for Future Research

This study adds to the knowledge base of the importance of predictability of reading fluency by foundational skills. This study considers how well Letter Naming Fluency, Letter Sound Fluency, and Phoneme Segmentation Fluency measures from a skills based universal screener predict Oral Reading Fluency at the end of third grade. Due to the sample size of 616, only these bookend years of kindergarten and third grade were included in the study. Study of correlations similar to this one, but looking at interim years as well, might be interesting to build the study out more to determine where learning breaks down or mastery begins. Such a study could include a correlation study of the same kindergarten students (from the same sample population) to Oral Reading Fluency at the end of first grade and or second grade would build on this existing study.

Future research could also include a study to track students flagged by the "Say Dyslexia" law (students with dyslexic characteristics) compared to students not flagged to determine if dyslexia specific interventions used with flagged students played a role in the correlations analyzed in a similar study.

Future research on the effectiveness of teachers who implement the science of reading in reading intervention classrooms could track students from K-2 interventions trained in the Early Literacy Supports Framework compared to students in this study. A

similar study could add teacher tracking numbers to each sample student data set in the current study along with likert scale to show professional development participation in science of reading trainings to date.

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