

PHONICS CURRICULUM-BASED MEASUREMENT: AN INITIAL STUDY OF  
RELIABILITY AND VALIDITY

BY

CHAD C. SWANSON

A DISSERTATION  
SUBMITTED TO THE FACULTY OF

ALFRED UNIVERSITY

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS  
FOR THE DEGREE OF

DOCTOR OF PSYCHOLOGY

IN

SCHOOL PSYCHOLOGY

ALFRED, NEW YORK

MAY 2014

PHONICS CURRICULUM-BASED MEASUREMENT: AN INITIAL STUDY OF  
RELIABILITY AND VALIDITY

BY

CHAD C. SWANSON

SUNY FREDONIA, B.A. (2009)

ALFRED UNIVERSITY, M.A. (2011)

**APPROVED BY**

Mark Fugate, Ph.D.

Committee Chairperson

Nancy Furlong, Ph.D.

Committee Member

Lynn O'Connell, Psy.D.

Committee Member

Hannah Young, Psy.D.

Committee Member

**ACCEPTED BY**

Mark Fugate, Ph.D.

Chairperson, Division of School Psychology

**ACCEPTED BY**

Nancy Evangelista, Ph.D.

Associate Provost and Dean, College of Professional Studies

**ACCEPTED BY**

Rick Stephens, Ph.D.

Provost & Vice President for Academic Affairs



### Dedication

~This work is dedicated to my parents, Jane and Ronald Swanson. Dad, thank you for being so supportive of my ambitions in life, even though you could not always be there to experience my achievements along with me. You will always be loved by your family and you are so dearly missed. Mom, you have always been my biggest cheerleader and a constant source of unconditional love. Thank you for always believing that I could succeed in achieving my goals in life, especially when I may not have truly believed in myself. What more can I say? You were right...I did it! ~

## Acknowledgments

I am so grateful to my loving family, supportive friends, and astute faculty at Alfred University. Each of you has contributed greatly to the person I have become today, and I share this accomplishment with each of you. I am humbled when I reflect on all those who have helped and supported me in achieving this enormous milestone in my life. As a child, I never knew that schools employed psychologists, let alone imagined that I could become one someday. However, I knew from a young age that I wanted to help people and dreamed that I would be able to make a difference in the lives of others. While, of course, there is always error in measurement, my gratitude to all those who helped me achieve this dream is most definitely immeasurable.

Dr. Gaughan, thank you for being such an important mentor and developer of my professional identity as a psychologist, teacher, and scholar. I will always remember your wisdom, humor, and dedication to my training as I reflect back on my graduate studies throughout my career. Dr. Faherty, thank you for your supervision and for giving me the autonomy to foster independence as a young practitioner while always lending a listening ear and sage advice when I needed guidance. Thank you, Dr. Atlas and Dr. Young, for allowing me to pursue my own research interests and helping me along the way to refine these ideas in to concrete projects. Additionally, thank you, Dr. Gagne and Dr. Furlong, for your time, energy, and supervision of my teaching experiences. I would also like to acknowledge Dr. Lauback, who invested countless hours of his time “talking shop” with students in his office, the student lounge, and at conferences to cultivate a collegial atmosphere.

Dr. Fugate, thank you for chairing this project. Very early on in the school psychology coursework, you inspired me to think differently about how to conceptualize academic,

behavioral, and social-emotional problems. While I continue to learn and build an eclectic skill set as a practitioner, I will always be rooted in viewing school and clinical problems from an ecological and behavioral framework. It is from this inspiration and philosophy that my dissertation topic was born. Thank you for sharing your wealth of expertise in reading development, academic assessment, and Response to Intervention (RtI). Thank you for coaching me throughout this process and working with me to keep on track of our lofty timelines.

Dr. O'Connell, thank you for serving on my dissertation committee. This dissertation topic was also highly influenced by your Academic Interventions course in which you taught me the importance of specificity in measurement. After the first week of my academic intervention project, I soon found out that there wasn't a measurement tool available to exactly monitor the early phonics skills I was teaching in the way that I wanted to monitor them. Without that experience in your course, I may not have pursued this area of research and I feel fortunate to have studied under your tutelage.

Dr. Furlong, thank you also for your help and support on my dissertation committee. Your inquisitiveness and intellectual curiosity is truly inspiring and often helped to reframe problems that came up when planning this study. I admire your critical thinking skills and appreciate all of your input in to this project. You were truly an asset to my committee!

Thank you again, Dr. Young, for all of your support on my dissertation committee as well as in the leadership grant. Your down-to-earth spirit always comforted my anxious nerves. Thank you for the time spent in reviewing all of my research project drafts as well as providing Jessica and me with an hour per week of respite (research seminar meetings) from the barrage of graduate school stressors being thrown at us. We had a blast working with you!

Thank goodness for my amazing mom who always put her children first and made sacrifices to provide them with opportunities to succeed to their fullest potential. I love you, Mom! I owe my work ethic to my dad, as he taught me how to work on our Christmas tree farm as a young boy. I will never forget the time we spent together planting, trimming, cutting, and selling Christmas trees together. Thank you to my grandparents for always believing in me. Thank you to Randy for being a good friend and father figure to me. Thank you to my brother, sister-in-law, and their children for showing me how fun and fascinating kids can be!

I also want to thank the Sandefers for all of their love and support. Thank you for accepting me in to the family with open arms! Kira, my loving sweetheart, I thank you so much for everything that you are to me. You have been a constant source of strength when I have needed it. Thank you for your consultation and sharing your expertise in reading development and RtI, especially when I was developing the P-CBM. I am so lucky to have found someone who is so intelligent, kind hearted, patient, and encouraging. You are such an amazing listener, confidant, and friend. But most importantly, I am grateful that we both have the same sense of humor so that you can put up with my daily shenanigans!

Thank you to all of my friends that have always been there for me along the way. Thank you to my cohort-mates for the fun times spent in Alfred, NY. My graduate school experience would not have been the same without each of you. Thank you to my best friends Joel and Tom. No matter how far away we are from each other, we always stay in touch and for that I am very thankful.

Lastly, I would like to acknowledge the educational professionals in the partnering school districts as well as my research team for making this project a reality. Thank you all so much!

## TABLE OF CONTENTS

Acknowledgments.....	iv
Abstract.....	x
Chapter I: Introduction.....	1
Word Recognition and Decoding.....	3
Theories of Word Recognition Development .....	4
Alphabetic Principle Scope and Sequence.....	6
Assessment of Alphabetic Principle and Decoding Skills .....	8
Current Study .....	13
Chapter II: Literature Review .....	15
Word Recognition and Decoding.....	17
Phonological processing. ....	18
Orthographic processing. ....	27
Meaning processing. ....	31
Theories of Word Recognition Development .....	33
Alphabetic Principle Scope and Sequence.....	43
Assessment of Alphabetic Principle and Decoding Skills .....	45
Traditional achievement and diagnostic testing. ....	46
Curriculum-based assessment. ....	49
Summary .....	54
Chapter III: Methods.....	56
Participants.....	56
Measures .....	56
Phonics curriculum-based measurement development .....	56
Criterion measures. ....	58

Procedures.....	60
Approval from partnering school district.....	60
Data collection training.....	61
Data collection.....	62
Design/ Analysis.....	63
Chapter IV: Results.....	65
Inter-rater Reliability.....	65
Research assistant training.....	65
Data collection.....	66
Alternate Forms Reliability.....	66
Concurrent Validity.....	67
Chapter V: Discussion.....	69
Limitations.....	75
Future Research.....	77
Conclusion.....	78
References.....	80
Tables.....	96
Table 1.....	96
Table 2.....	97
Table 3.....	98
Table 4.....	99
Table 5.....	100
Appendix A: Cover Letter for Research Request.....	101
Appendix B: Request for Research Form.....	102
Appendix C: Passive Informed Consent Form for Partnering School 1.....	104

Appendix D: Passive Informed Consent Form for Partnering School 2 .....	106
Appendix E: Teacher Outreach Letter for Partnering School District 1 .....	108
Appendix F: Teacher Outreach Letter for Partnering School District 2 .....	109
Appendix G: Videotape Consent Form for Sample Child .....	110
Appendix H: ABCD Interobserver Agreement Data Chart .....	111
Appendix I: Biographical Sketch .....	112

## Abstract

Early literacy and reading skills are both important predictors of an individual's future success in school and employment settings (Moats, 1999). Moreover, poor reading performance in elementary school has been associated with future conduct problems and juvenile delinquency by age fifteen (Williams, 1994). Research supports the notion that scientifically-based instruction provides all students with the best opportunity to prevent future academic, behavioral, and vocational problems associated with poor reading skill acquisition. The current study investigated the reliability and validity of a curriculum-based measure developed by the current author named Phonics Curriculum-Based Measurement (P-CBM). Two hundred and twenty five first grade students (117 males, 103 females) from two partnering school districts in rural western New York State were included in the study. The results indicated strong alternate forms reliability, inter-rater reliability, and concurrent validity. Upon further validation, P-CBM could be helpful in making screening, progress monitoring, or instructional planning decisions as well as providing pre-referral data to school psychologists who are conducting special education eligibility evaluations for a specific learning disability in reading.

## Chapter I: Introduction

Schools are charged with educating youth and preparing students to become future productive members of society. One predictor as to whether an individual will enjoy academic success, secure employment, and be fully independent as a citizen is reading proficiency (Moats, 1999). Although schools must teach all students how to read, the reality is that all students enter school with diverse levels of preparedness to begin learning to read. For example, oral language development is one of the most critical areas of development that will predict a student's ability to learn early literacy and reading skills (Joseph, 2006; Moats, 1999). Some children are provided with enriched environments from birth to the beginning of kindergarten and are better prepared to develop essential early literacy skills. Other children do not have high quality and quantities of verbal interactions with caregivers, engage in storytelling and storybook reading, or have other enriching experiences. Despite the challenges of entering school with few experiences in developing language and early literacy skills, research supports the notion that scientifically-based reading instruction which explicitly teaches children reading skills can enable all students to become effective readers (Moats, 2007; National Reading Panel [NRP], 2000).

Reading has been thought to be so essential that, in 1997, Congress asked the director of the National Institute of Child Health and Human Development (NICHD) and the Secretary of Education to assemble a national panel to assess the status of research-based knowledge in reading (NRP, 2000). The panel, which consisted of leading scientists in reading research, representatives of colleges of education, teachers, administrators, and parents, reviewed hundreds of reading studies since the mid 1960s. The NRP subsequently published a report in 2000 which detailed best practices in reading instruction and identified five main areas of reading skill

development (NRP, 2000). These *Big Five* areas of reading skills include *phonemic awareness*, *alphabetic principle*, *fluency with connected text*, *vocabulary*, and *comprehension*. Direct instruction within these five areas of reading has been found to be more effective than other reading instructional approaches, such as the whole language approach (Moats, 2007; NRP, 2000).

Phonemic awareness is defined as the ability to discriminate and manipulate phonemes in spoken words (NRP, 2000). Phonemes are considered the smallest units of speech sounds (Hosp & MacConnell, 2008) and examples of phonemic awareness tasks include identifying the first phoneme in a word, manipulating first or last phonemes to create new words, and blending phonemes to create words (Kilpatrick, 2012; NRP, 2000). Once beginning readers have developed phonemic awareness, they are better able to connect phonemes with letters in printed words (Hosp & MacConnell, 2008). This ability is referred to as alphabetic principle (Joseph, 2006) and is often taught explicitly through various forms of phonics-based instruction (NRP, 2000). The benefit of teaching children phonics is that once basic letter-sound correspondences are learned, children are able to teach themselves new words by using phonics generalization rules (e.g., “When a word has only one vowel letter, the vowel sound is likely to be short;” “Words having a double *e* usually have the long *e* sound”) to decode an unknown target word (Juel & Minden-Cupp, 2000).

Fluency with connected text refers to a reader’s ability to read words in text with accuracy and expression (NRP, 2000). Both oral and print vocabulary is critically important in oral reading instruction. For example, a fluent reader who encounters an unknown word in print could decode the word to speech and if it is in the reader’s oral vocabulary the reader could understand it (NRP, 2000). It would then be more likely that the reader would be able to

understand and remember the entirety of the sentence. Therefore, fluency and vocabulary both positively impact reading comprehension (Yovanoff et al., 2005), which is the last area of reading skill development that was identified by the NRP (2000).

### **Word Recognition and Decoding**

Even though the end goal of reading is to achieve comprehension of written material, there are many discrete reading sub-skills that students must master in order to develop the ability to comprehend what is read (Adams, 1990). Early literacy skills, such as phonemic awareness and alphabetic principle, are the essential building blocks for later reading development. For example, the inability to develop word recognition skills is one of the primary causes of reading difficulties (Adam, 1990; Torgesen, 2002). When readers expend most of their cognitive energy attempting to recognize words from print, they have fewer cognitive resources to be able to read text fluently, access word meanings, and ultimately understand and remember what was read. In contrast, skilled readers develop sight word reading which allows them to read text more fluently, accurately, and with expression because even a quick glance at a word activates information about the word's phonology and meaning (Ehri, 2007). The development of strong word recognition skills in isolation and within text facilitates reading comprehension (Cutting & Scarborough, 2006).

Given the importance of developing word recognition skills, decoding is a technical and necessary skill for beginning readers to acquire in order to become skilled in word recognition. Decoding refers to one's ability to "exploit the alphabetic principle in order to decipher written words" (Hoiem-Tengesdal & Tonnessen, 2011, p. 93). When students are unable to develop decoding skills they tend to read slower (Adams, 1990). Labored reading fluency is often associated with poor reading comprehension (Ehri, 2007) and can lead to frustration and an

avoidance of reading, which often may perpetuate reading problems (Rasinski, 2000).

Moreover, research has found that reading comprehension skills are positively correlated with reading self-concept (Katzir, Lesaux, & Kim, 2009). In sum, students are often aware of their reading abilities and direct instruction in decoding strategies may prevent future reading comprehension difficulties as well as poor self-concept in reading.

### **Theories of Word Recognition Development**

Many theories of word recognition have been posited to explain how readers begin to integrate information from various processing systems (i.e., phonological, orthographic, semantic) and eventually recognize words in print. Some of these theories have been developmental in nature and include a continuum of stages representing differing levels of word reading skills. For example, Gough and Hillinger (1980) proposed one of the first stage models and theorized two stages of word recognition. They believed that beginning readers enter a paired associate reading stage and read words by associating visual and graphic representations of the letter sequences with the word in their memory. After this stage, advanced readers enter a second and final stage in which phonics strategies are utilized to decode words. Subsequent theories have agreed with Gough and Hillinger's (1980) notion that early readers tend to engage in the paired associative learning stage of reading, which was later referred to as logographic reading or visual cue reading; however these theories further broke down their second stage of reading into separate phases of reading development (Ehri, 1995; Frith, 1985). In general, these later theories postulate that readers pass through various developmental phases which allow them to decode words by individual phonemes (e.g., /p/ /i/ /g/), then by larger linguistic units such as onsets and rimes (e.g., /p/ /ig/) or syllables in multisyllabic words (e.g., /win / /ter/), and finally

by recognizing the entire word as a sound and reading it automatically (e.g., *pig*; *winter*) (Ehri, 1995; Frith, 1985).

Other theories of word recognition development have not focused on developmental phases, but focus more functionally on the development of phonological and orthographic skills and how these two processors activate semantic word meanings. The dual route theory proposes that word recognition development occurs because of two distinct pathways from the written word to semantic meaning. The first pathway is a direct route to the semantic meaning of a word and is orthographic in nature (Laszlo & Federmeier, 2007). The other route is through the phonological processor which is more indirect and involves the transitional step of decoding words through converting graphemes (i.e., written linguistic units) to phonemes (i.e., language sounds) and eventually blending these phonemes together to pronounce the word (Lukaleta & Turvey, 1998). In general, this theory proposes that if a word is familiar to a reader, the orthographic processor will automatically activate word recognition and meaning based on the visual features of the words such as letter order. However, if a reader comes across an unfamiliar word, word recognition must be activated through the more indirect and slower phonological route.

A connectionist theory of word recognition has also been proposed which challenges the inherent notion of the dual route theory that phonological and orthographic routes are independent pathways to word recognition (Seidenberg & McClelland, 1989). Instead, the connectionist model proposes that information from the orthographic, phonological, and meaning processors all flow freely within one another and these systems activate one another to aid in the process of word recognition (Laszlo & Federmeier, 2007). Seidenberg and McClelland (1989) believe that readers learn to associate the orthographic codes for words with their meanings and

pronunciations. In other words, even though a reader can read a word by sight, the orthographic processor sends feedback to the other processors which then activate the word's phonological and semantic information. The connectionist theory would indicate that a reader may not be consciously thinking about a word's phonology, but this system is still activated to aid in pronunciation and word meaning.

Taken together, these theories help to uncover the process of word decoding. In general, the stage, dual route, and connectionist theories indicate that as readers develop letter and sound connections they are able to utilize orthographic and phonological information that is essential to decoding words. At different stages of word recognition development, readers have differing orthographic and phonological abilities. As the phonological and orthographic processors develop, students develop better efficiency in using phonic generalization rules which facilitate word recognition development (Adams, 1990). In order to help children succeed in uncovering the written code, assessment of alphabetic principle is paramount in order to provide information to the educator about the reader's word recognition development. This information will allow educators the ability to tailor instruction to the individual needs of the student.

### **Alphabetic Principle Scope and Sequence**

Phonics instruction typically begins after students have had explicit instruction in phonological and phonemic awareness. Beck (2006) indicates that early in the instructional sequence for teaching a letter-sound relationship, attention must be brought to the target letter and its pronunciation in all positions in which the letter is found in words. For example, when teaching the letter *p*, the student must understand that it makes the /*p*/ sound at the beginning of a word, such as *pad*, as well as the end of a word, such as *mop*. Additionally, research indicates that letters should not be taught in alphabetic order, but instead should be taught according to the

most important, or most frequently observed, letter-sound correspondences within words (Fry, 2004). Phonics curricula, such as California Treasures (Macmillian/ McGraw-Hill, 2013), Scott Foresman Reading Street (Pearson, 2011), and the New York State (NYS) Common Core modules (“Engage New York”, 2013) all introduce the most important and common letters to students first before teaching the rest of the alphabet. This strategic introduction of letter-sound connections scaffolds learning for the student so that they will likely be more successful in reading words that contain high frequency letter-sound correspondences.

Once students have learned basic letter-sound correspondences for both consonant and short vowel sounds in isolation and in one syllable vowel-consonant (VC) and consonant-vowel-consonant (CVC) words, students begin learning more advanced phonics skills. For instance, consonant blends, such as *sl*, *sk*, *sw*, and *nt*, and consonant digraphs, such as *ch*, *sh*, *th*, and *ng*, are typically introduced after teaching letter sound correspondences in isolation and in CVC words (e.g., “Engage New York”, 2013; Macmillian/ McGraw-Hill, 2013; Pearson, 2011). The next skills taught to students are typically long vowel silent-e and vowel digraphs. Silent-e words are those that have a CVCe pattern, where the first vowel sound is long while the *e* is silent at the end of the word (e.g., *bike*). Vowel digraphs, such as *ai*, *ee*, and, *oa* are similar in that the first vowel sound is long while the second vowel is silent.

The previous skills mentioned (e.g., CVC, consonant blends, consonant digraphs, silent-e, vowel digraphs) are all commonly taught by the end of first grade (“Engage New York, 2013; Macmillian/ McGraw-Hill, 2013; Pearson, 2011). Within the NYS Common Core modules, all of these skills except vowel digraphs are introduced in kindergarten. Scott Foresman Reading Street (Pearson, 2011) is similar, however, long vowels are not taught until first grade. More advanced phonics skills are then taught in second grade in order to continue developing student’s

decoding skills. For example, students begin learning to decode *r*-controlled vowels (e.g., *car*), vowel diphthongs (e.g., *oi* as in *oil*), irregularly spelled words (e.g., *one*; *said*), regularly spelled two syllable words with long vowels, words with common prefixes (e.g., *in-*; *un-*) and suffixes (e.g., *-ed*; *-ing*), and phonographs or word families (e.g., *ake*) (“Engage New York”, 2013; Pearson, 2011).

### **Assessment of Alphabetic Principle and Decoding Skills**

Since the inception of the No Child Left Behind Act (NCLB) in 2001, evidence-based practices in reading have become a major area of interest in the field of education. The NCLB Act required school districts, which were eligible to receive Reading First federal grant money, to employ evidence-based instructional practices to improve their schools. Utilizing appropriate assessment tools to measure students’ reading skill acquisition is an essential aspect of evidence-based practice. Hosp and Fuchs (2005) asserted that assessments are needed to help educators efficiently and accurately screen, diagnose, and monitor reading progress in the early grades in order to ensure that all students will become effective readers.

Tests can be useful sources of data because they measure specific behavioral responses to predetermined item sets so that examinee performances can be compared to a normative comparison group or to set criterion (Salvia et al., 2010). In terms of measuring alphabetic principle and decoding skills, many tests are available for making different decisions. Standardized achievement tests are often used to identify broad reading skill development. For example, the Woodcock Johnson Tests of Achievement, 3<sup>rd</sup> Edition (WJ-ACH III; Woodcock, McGrew, & Mather, 2001) contains subtests such as Letter- Word Identification and Word Attack which measure a reader’s ability to identify letter names, decodable real words, common sight words, as well as to decode pseudowords. Similarly, the Wechsler Individual Achievement

Test, 3<sup>rd</sup> Edition (WIAT-III; Wechsler, 2010) devotes a subtest to early reading skills which covers both phonological and phonemic awareness and beginning alphabetic principle skills. Additionally, the WIAT-III contains subtests such as Word Reading and Pseudoword decoding which are similar to the subtests measured by the WJ-III and measure the ability to read and decode words and pseudowords.

While achievement tests provide a breadth of initial information about strengths and weaknesses in specific academic areas, such as reading, they do not provide a sufficient depth of information about skill development within each of the five domains of reading development. For instance, only one subtest is devoted to measuring decoding skills when presented with unknown pseudowords on the WJ-ACH III and WIAT-III. Because of this, many sub-skills of alphabetic principle (i.e., consonant and vowel digraphs; consonant blends; r-controlled vowels) are not measured, and if they are, only one or two items are typically included to represent the sub-skill. In contrast, norm-referenced diagnostic reading tests, such as the Woodcock Reading Mastery Test, 3<sup>rd</sup> Edition (WRMT-III; Woodcock, 2011) and the Early Reading Diagnostic Assessment (ERDA; The Psychological Corporation, 2003), are administered to students to supplement reading data from omnibus achievement tests. These norm-referenced diagnostic tests typically contain subtests which measure each of the skills within the Big Five areas of reading with more depth. For example, the WRMT-III states in the user's manual that the test developers used the NRP's findings to link subtests to the Big 5 areas of reading in order to validate the test (Woodcock, 2011). While these diagnostic tests do add more samples of items for particular sub-skills, these tests still measure a wide range of skills which make it difficult to use for instructional planning decisions in regard to specific skills that should be taught during intervention.

Other norm-referenced diagnostic tests, in contrast, measure fewer reading skills, but do so with more depth. Given that these tests might provide more information about specific alphabetic principle skills, these tests can be useful in instructional planning decisions. For example, the Test of Word Reading Efficiency (TOWRE) measures decoding efficiency as well as sight word efficiency (Torgesen, Wagner, & Rashotte, 1999). The Phonics-Based Reading Test (PRT) is another test that measures decoding skills and follows a scope and sequence of increasingly complex phonics skills from letter names and sounds, to short and long vowels, to multisyllabic words (Brownell, 2002). These tests are scored by converting raw scores to standard scores in order to compare performances to a normative sample.

Other diagnostic reading tests, in contrast, are considered criterion referenced tests and do not utilize a normative comparison group. Criterion measures instead utilize either formal or informal cut scores to determine whether or not a student's current performance is following a trajectory which would predict future success. For example, the Developmental Reading Assessment, K-3, second edition (DRA-2, K-3; Beaver & Carter, 2006) is a criterion referenced reading test that measures a variety of reading skills including alphabetic principle skills. Instead of comparing student performance to normative data, examinee scores are translated to a reading level and described in terms of *Intervention*, *Instructional*, *Independent*, and *advanced*. Similarly, the Diagnostic Assessments of Reading (Roswell, Chall, Curtis, & Kearns, 2005), second edition is a criterion referenced diagnostic test which measures letter sounds, consonant blends, silent-e words, vowel digraphs, diphthongs, r-controlled vowels, two syllable, and multisyllable, is the Diagnostic Assessments of Reading, second edition. The 95% Group Phonics Screener for Intervention (PSI; 95% Group Inc., 2013) is an example of an informal criterion referenced diagnostic tool that follows a similar alphabetic principle skill scope and

sequence to the PRT The PSI is scored using an informal percentage correct mastery criterion of 90% correct for each of the administered skill areas.

Each of the aforementioned norm-referenced and criterion referenced diagnostic tests take at least 20 minutes to administer and do not contain more than two alternate forms. The PSI measure is the most efficient diagnostic test, with administration times between five and 10 minutes, but little psychometric information is available regarding this instrument. The PSI also utilizes an informal accuracy criterion which does not enable examiners to compare student performance to a normative comparison group or an established reliable and valid criterion cut score. Additionally, all of the aforementioned tests contain small item samples of several phonics sub-skills, which make it difficult to determine if specific phonics skills are improving with instruction. So, while these tests may be helpful in determining skills to target for instruction or intervention because they provide specific information regarding a reader's alphabetic principle skill acquisition and progression, they would not be ideal for use in universal screening or progress monitoring decisions. Instead of using norm-referenced or criterion-referenced diagnostic tests, curriculum-based measurement (CBM) is widely used for screening and progress monitoring purposes in the areas of reading, mathematics, written expression, and spelling (Deno et al., 2009). Curriculum-based measures formatively measure skill areas that are more closely tied to curricula than traditional standardized achievement tests, have adequate reliability and validity, have standardized administration and scoring rules, are time efficient and cost effective, and have multiple equivalent forms (Deno, 2003). Additionally, if CBM tools are used within a preventative problem-solving model of service delivery, such as Response to Intervention (RtI), they can be used as an alternative assessment system for determining learning disability eligibility for special education services (Lichtenstein, 2008).

Curriculum-based measures are considered to be general outcome measures (GOMs) because they measure important skills which predict future success in particular areas of achievement and are focused on long term goals for mastering a curriculum (Deno, 2003; Shapiro, 2004). The Dynamic Indicators of Basic Early Literacy Skills Next (DIBELS Next; Kaminski & Good, 2011) and the AIMSweb system (AIMSweb, 2012) are widely used commercial CBM systems that measure reading skills. To measure growth in alphabetic principle and word decoding skills, the DIBELS Next system utilizes a measure called Nonsense Word Fluency (NWF). NWF contains vowel-consonant (VC) and consonant-vowel-consonant (CVC) words and measures a student's skill to decode basic pseudowords. Similarly, the AIMSweb system contains probes which measure individual letter sound knowledge (Letter Sound Fluency [LSF]) and VC/CVC words (NWF) (AIMSweb, 2012). Curriculum-based measures for both DIBELS Next and AIMSweb include standardized instructions, have a scoring procedure of calculating correct items for a total score, contain multiple equivalent forms, and only take one minute to administer. Both DIBELS Next and AIMSweb utilize criterion cut scores to determine performance on the measures; however, AIMSweb also offers a normative comparison option at various levels (i.e., national, district, school, grade, and classroom).

One disadvantage of DIBELS Next and AIMSweb is that there is currently not a measure that assesses alphabetic principle skills beyond CVC words. NWF uses pseudowords to measure VC and CVC words, but other important phonics skills such as long vowels, consonant blends, consonant and vowel digraphs, or multisyllabic words are unable to be measured. This can present a problem for educators who are providing phonics instruction to students who have mastered individual letter sounds, such as VC and CVC words but who struggle with more complex alphabetic principle skills. Educators must either decide to use NWF or use teacher-

created measures with unknown reliability and validity to determine mastery of alphabetic principle skills. Some educators may decide to use a GOM such as an oral reading fluency (ORF), which measures how many words a student reads in one minute. However, the ORF is not sensitive to change in specific alphabetic principle skills. While reading fluency may improve due to phonics instruction, it will not provide specific feedback regarding alphabetic principle skill development which is needed to effectively guide phonics instruction. Therefore, there is currently a need for a CBM-tool to measure alphabetic principle skills, in order to monitor growth of specific alphabetic principle skills and to guide instructional practices.

### **Current Study**

The current study will establish the reliability and validity of a measure of alphabetic principle entitled *Phonics Curriculum-Based Measurement (P-CBM)*. This measure will fill a void in phonics assessment that exists by assessing multiple phonics skills and casting a wider measurement net of basic phonics skills than the DIBELS Next or AIMSweb NWF measure. Specifically, it will include a larger sample of items for the basic alphabetic principle skills (i.e., CVC, consonant blends, consonant digraphs, silent-e words) that would appear on diagnostic tests of alphabetic principle skills such as the TOWRE, PRT, and 95% Group PSI. The intent of P-CBM is to be used as a screening tool to identify students who are struggling with basic alphabetic principle skills. Once these students are identified, P-CBM will also be useful in making instructional planning and progress monitoring decisions.

Three research questions will guide this test construction study. The first two research questions are in regard to reliability. (1) Will the P-CBM have acceptable inter-rater reliability as indicated by calculating interobserver agreement across raters? (2) Will the P-CBM consistently measure basic alphabetic principle skills across three alternate forms? The third

research question is in regard to validity. (3) Will the P-CBM have acceptable concurrent validity with established measures of alphabetic principle?

## Chapter II: Literature Review

The National Reading Panel (2000) (NRP) was responsible for reporting the current knowledge base of the most effective strategies for teaching students to read. The NRP (2000) identified what is now known as the *Big Five* areas of reading (i.e., phonemic awareness, alphabetic principle, fluency with connected text, vocabulary, and comprehension). The NRP (2000) recommended that these five areas of reading be the focus of instruction and it defined each main area in the report. Systematic and direct instruction within these five components of reading has been found to be more effective than other instructional approaches, such as the whole language approach, to teaching reading (Moats, 2007).

Phonemic awareness was defined as the ability to discriminate and manipulate phonemes in spoken words (NRP, 2000). Phonemes are the smallest units which comprise spoken language (Adams, 1990) and are typically referred to as sounds (Hosp & MacConnell, 2008). Some key phonemic awareness tasks include recognizing phonemes in isolation, identifying common phonemes among words, categorizing words based on similar phonemes, blending phonemes together to make words, segmenting and breaking words into specific phonemes, and recognizing new words when a phoneme is deleted (Kilpatrick, 2012; NRP, 2000). Hosp and MacConnell (2008) assert that it is important to teach phonemic awareness explicitly because the ability to hear and manipulate sounds in words is an essential prerequisite to learning letter and sound correspondences within printed text.

Phonics was defined by the NRP (2000) as the instructional method used to teach students letter and sound correspondences. Knowledge about the association between letters and sounds is referred to as the alphabetic principle (Joseph, 2006). The NRP (2000) identified several approaches that have been used to teach the alphabetic principle which include synthetic

phonics, analytic phonics, embedded phonics, analogy phonics, onset-rime phonics, and phonics through spelling. While all of these approaches differed in their method of teaching letter-sound correspondences, they were all found to be significantly more effective than non-phonics approaches (NRP, 2000). The benefit of teaching children phonics skills is that once basic letter-sound correspondences are learned (e.g., onsets, rimes, short vowels), children are able to teach themselves new words by decoding and recoding the unknown word (Juel & Minden-Cupp, 2000).

The three other important areas of reading that the NRP (2000) identified are fluency with connected text, vocabulary knowledge, and comprehension. These three areas of reading are closely related in that comprehension, or the ability to understand and make meaning from text, is a skill that relies on both fluency and vocabulary development. For instance, reading fluency and vocabulary explain between 40-50% of the variance in reading comprehension (Yovanoff et al., 2005). The ability to read text fluently is contingent on an individual's ability to decode words in isolation with automaticity, but the NRP (2000) asserts that word recognition skills do not inevitably lead to fluency. Automaticity with decoding and identifying words in isolation is important, but reading fluency refers more to the accuracy, efficiency, and expression of passage reading (Carnine et al., 2004). The NRP (2000) asserted that it is important to explicitly teach oral reading fluency strategies to students in order to develop as effective readers.

While oral reading fluency should be taught explicitly in younger grades because it is a good predictor of comprehension, fluency becomes less predictive of reading comprehension for older students because oral reading rates tend to plateau during grades five through eight (Yovanoff et al., 2005). In contrast, Yovanoff et al.(2005) found that vocabulary knowledge

tends to be a better predictor of overall reading comprehension in all grades, especially older students. *Word callers*, who read words with ease but do not understand or remember what is being read, highlight the limitation of using oral reading fluency scores as a predictor of comprehension. When working with students who can read fluently but struggle with understanding and remembering read material, direct instruction in vocabulary and building reading comprehension strategies may be more effective (Joseph, 2006).

### **Word Recognition and Decoding**

Even though the end goal of reading is to achieve comprehension of written material, there are many discrete reading sub-skills that students must master in order to develop the ability to comprehend what is read (Adams, 1990). The development of a reader's ability to make letter-sound correspondences is the basis for learning decoding skills which enables a person to ultimately recognize and identify words. For example, differences in word reading skills have been found to manifest themselves most clearly at the level of individual letter-sound connections (Assink, Lam, & Knuijt, 1998). Decoding requires the individual to attend to the grapheme details of the word (what is written), identify phonemes represented by the graphemes, blend a string of phonemes, and finally read the word (Soltani & Roslan, 2013). The process of developing decoding and word recognition skills appears to be mediated by the development of phonological and orthographic processing systems that work in concert with one another (Adams, 1990; Seidenberg & McClelland, 1989; Torgesen, & Wagner, 1992). The meaning, or semantic, processor is a third system that allows a reader to make meaning of words when they are recognized (Adams, 1990; Seidenberg & McClelland, 1989). These three processing systems coordinate and synthesize various types of information instantaneously while the reader

simultaneously uses contextual information from the text in order to produce fluent and automatic reading.

**Phonological processing.** Phonological processing refers to the use of the sounds of one's language in the processing of written and oral language (Wagner & Torgesen, 1987). Any language has a series of both meaningful and meaningless sound segments within its overall structure (Liberman, Shankweiler, Fischer, & Carter, 1974). Both meaningful and meaningless sound segments vary in the size of their linguistic units. Liberman et al. (1974) asserted that meaningful segments can be as long as sentences or short as words, while meaningless segments include longer units such as syllables and shorter units such as the individual phoneme. The phonological processor accepts speech information (both meaningful and meaningless sound segments) and activates its phonological image to aid in the pronunciation of a particular segment (Adams, 1990). This occurs within conscious and unconscious awareness (Scarborough & Brady, 2002) and the more familiar a particular sound segment is to an individual, the more efficiently the phonological processor will activate the expressive pronunciation or receptive perception of the linguistic unit (Adams, 1990).

Researchers have investigated phonological processing and its relation to reading development (e.g., Liberman, 1973; Nelson, Lindstrom, Lindstrom, & Denis, 2012; Wagner et al., 1997; Wagner & Torgesen, 1987; Wagner, Torgesen, Laughon, Simmons, & Rashotte, 1993). One method of studying the relation between phonological processing and reading development is to investigate individuals who have not acquired strong reading skills. Dyslexia is a specific reading disability that causes an individual to have significant difficulty in decoding words with speed and accuracy (Siegel, 2006). Dyslexia has been most associated with a phonological processing deficit which makes word decoding very challenging and laborious

(Habib, 2000; Shaywitz, Lyon, Shaywitz, 2006; Snowling, 1981). As Wagner and Torgesen (1987) point out, “an individual lacking such [phonological] awareness will find the correspondence between symbol and sound capricious at best” (p. 192). In other words, pre-readers who do not acquire awareness of phonemes are at greater risk of not learning how to successfully decode words (Adams, 1990; Juel, Griffith, & Gough, 1986).

***Phonological awareness.*** This literature suggests that individuals with dyslexia have difficulty developing the Big Five area of phonemic awareness, which is the ability to discriminate and manipulate phonemes in spoken words (NRP, 2000). While phonemic awareness is a critical aspect of reading development and phonological processing, it has been largely identified as one skill area under a larger umbrella of a major phonological processing ability named *phonological awareness* (Richgels, 2001). Phonological awareness is defined as the ability to sense and manipulate the sound structure of oral language (Nelson et al., 2012), typically referring to units of speech larger than the individual phoneme (Pufpaff, 2009). The awareness of larger linguistic units of sounds such as sentence clauses, individual words, and syllables is an important prerequisite to becoming an effective reader (Adams, 1990). Additionally, phonological awareness includes the ability to detect other aspects of language such as intonation (e.g., subtle voice inflections that differentiate a sentence ending as a statement and question), alliteration (i.e., repetitions of particular sounds in multiple words such as ) rhyming (e.g., “sad” and “bad”) , and onset and rimes (e.g., /ch/ /air/) (Armbruster, Lehr, & Osborn, 2001).

Evidence in the literature suggests that individuals who have developed phonological awareness will find the alphabetic system to be a reasonable system for representing spoken language with written symbols (Wagner et al., 1987). Awareness of the sound segments of oral

language, particularly phonemes, is essential because for an individual to combine letter strings together to decode a word, the individual must be knowledgeable about the phoneme-grapheme connection. Correlational studies have examined the relationship between phonological awareness and decoding ability and have found positive associations (e.g., Hester & Hodson, 2004). Moreover, Wagner and colleagues (1997) found that phonological awareness not only predicts beginning reading performance, but, in fact extends, at least through fourth grade, which indicates that phonological awareness is an important predictor variable for future reading performance. Furthermore, recent evidence indicates that strong performance on phonological awareness tasks predicts incidental word learning, which is the ability to implicitly learn a new word after minimal exposure and no direct instruction (Ramachandra, Hewitt, & Brackenbury, 2011).

One can think of phonological awareness skills on a continuum from the ability to distinguish gross linguistic differences to the ability to manipulate an individual phoneme. Generally, it is necessary for a child to acquire the lower-level phonological awareness skills before they will be successful with higher-level phonemic awareness tasks (Pufpaff, 2009). For example, the ability to distinguish gross differences between two spoken words is an easier skill and would develop before the ability to determine which two words rhyme when presented with three stimulus words. Likewise, segmenting a sentence into words is an easier task and would develop before the ability to segment a word into phonemes.

The continuum of phonological and phonemic awareness skills that exists has been referred to as *phonological sensitivity* (Lonigan, 2006; Stanovich, 1992). Researchers assert that the two terms of phonological awareness and phonemic awareness have been used interchangeably in the past and that this has created confusion among scholars and practitioners

in reference to which skills they are actually assessing and teaching (Richgels, 2001; PufPaff, 2009). Stanovich (1992) coined the term phonological sensitivity and conceptualized phonological and phonemic awareness tasks on a continuum as a way of being more precise about which specific skills were being investigated. He indicated that the processing of linguistic units are arranged on a continuum from *shallow sensitivity* (i.e., larger sized linguistic units such as syllables) to *deep sensitivity* (i.e., smaller sized linguistic units such as phonemes). The use of the term phonological sensitivity provides a more accurate conceptual framework for the developmental sequence of phonological and phonemic awareness skills.

Pufpaff (2009) reviewed over thirty years of research in the literature that investigated the developmental nature of phonological sensitivity. No previous study had examined every specific phonological awareness and phonemic awareness skill, but all studies that Pufpaff (2009) reviewed did investigate multiple phonological and/or phonemic awareness skills. For example, a seminal article by Liberman and colleagues (1974) was one of the first to indicate that there was, in fact, a relationship between word segmentation ability and reading acquisition. Specifically, they found that young children had a greater degree of difficulty segmenting individual phonemes compared to segmenting syllables, which suggests that phoneme segmentation ability (a phonemic awareness task) develops relatively later than syllable segmentation ability (a phonological awareness task). Goldstein (1976) shortly after found that syllable blending and segmentation developed before phoneme blending and segmentation which was consistent with Liberman et al.'s (1974) findings. These studies are two examples in the literature which indicate that the processing of larger segments of sounds and phonological awareness tasks develop before the ability to process smaller segments of linguistic units that comprise phonemic awareness tasks.

In another study that Pufpaff (2009) reviewed, Stahl and Murray (1994) found that kindergartners and first graders have a more challenging time identifying the final consonant phoneme than the initial consonant phoneme in consonant-vowel-consonant (CVC) words. Additionally, they found that phoneme isolation tasks were easier than phoneme blending tasks and that phoneme deletion tasks are easier than phoneme segmentation. Stahl and Murray's (1994) study is one example of many others cited in Pufpaff's (2009) literature review (e.g., Skjelfjord, 1976; Vandervelden & Siegel, 1995) that have provided evidence for a developmental sequence of phonemic awareness skills.

As mentioned, no other study before Pufpaff's (2009) had investigated all phonological sensitivity skills to create a developmental sequence of skills. In order to develop a developmental sequence, PufPaff (2009) reviewed findings from previous experimental and quasi-experimental studies which explicitly studied the developmental progression of phonological sensitivity skills to construct a general developmental hierarchy of phonological and phonemic awareness skills. The phonological sensitivity hierarchy consists of the two major skills of phonological awareness and phonemic awareness with several discrete skills in a rank ordered list below each major skill area. Examples of specific phonological awareness skills include rhyming (e.g., detection, creation, oddity), syllables (e.g., blending, segmentation, deletion), and sentence segmentation. Some phonemic awareness skills include phoneme blending, sound-to-word matching (initial phoneme recognition; final phoneme recognition; phoneme location; phoneme recognition and location), and word-to-word matching (Initial consonant same; initial consonant different; identification of deleted phoneme; final consonant same; final consonant different). See Table 1 for a full review of the developmental hierarchy of phonological sensitivity skills.

The major implication of Pufpaff's (2009) literature review and developmental hierarchy is the finding that children should generally be taught phonological sensitivity skills sequentially from word-level skills, to syllable-level skills, and then to phoneme-level skills. Pufpaff (2009) notes that it is important for young children to understand that spoken language can be broken into parts, recognize similarities and differences in those parts, and then ultimately manipulate those parts even before teaching children to identify and manipulate individual phonemes. While there is strong evidence that a continuum of phonological sensitivity exists, it is important to note that research has also displayed that children acquire both phonological and phonemic awareness skills with some overlap (Anthony, Lonigan, Driscoll, Phillips, & Burgess, 2003). This suggests that while a general developmental hierarchy exists, it is important for educators to introduce, teach, and assess groups of phonological sensitivity skills that are close to one another on the hierarchy, rather than teaching one skill at a time to mastery.

***Phonological memory and rapid naming.*** Although important, phonological and phonemic awareness are not the only skills that have been associated with phonological processing. Two other components of phonological processing that are closely related to word decoding ability are phonological short-term memory and rapid automated naming (Wagner & Torgesen, 1987; Wagner et al., 1997). Phonological memory refers to the ability to store phonological information and details within working memory for a short period of time (Soltani & Roslan, 2013; Wagner & Torgesen, 1987). Rapid automated naming is a commonly used task to measure the ability to retrieve phonological codes from long term memory (Wagner et al., 1997). These two cognitive operations are part of the storage, retention, retrieval, and production of phonological information and are often thought of as critical aspects of phonological processing (Scarborough & Brady, 2002).

Baddeley (1992) describes working memory as a brain system that allows for temporary storage and manipulation of information that is necessary for complex cognitive tasks such as language comprehension, learning, and reasoning. The most popular and conventional theory of working memory posits that there are three main components to working memory which consist of a master system called the central executive and two slave systems named the visuospatial sketchpad and phonological loop (Baddeley & Hitch, 1974). The central executive is responsible for attention, planning, and coordination of the two slave systems while the visuospatial sketchpad encodes visual information into working memory and the phonological loop stores and rehearses speech-based information (Baddeley, 1992). Baddeley (1992) indicates that subvocalization (e.g., mouthing words or speech sounds without saying them aloud) allows an individual to maintain auditory information within the phonological loop as well as to register visually presented stimuli such as words or pictures into phonological codes. This suggests that a reader's ability to consciously decode a word by segmenting each phoneme, remembering what was segmented, and then ultimately recoding the individual phonemes to read the word is at least somewhat dependent on the phonological loop within working memory (Baddeley, 1982; Wagner & Torgesen, 1987).

Studies indicate that phonological memory deficits negatively impact word decoding. For example, correlational studies indicate a positive relationship between phonological memory and reading decoding ability (Gathercole, Willis, & Baddeley, 1991; Kibby, 2009; Nithart et al., 2011; Soltani & Roslan, 2013). Additionally, a longitudinal study displayed that phonological memory deficits, as measured by a non-word repetition task, were found to persist in children with specific language disorders and delayed literacy compared to normal controls (Vandewalle, Boets, Ghesquiere, & Zink, 2012). Kibby (2009) notes that phonological memory is especially

important for word decoding of novel words because these words are not as familiar and will not be recognized with automaticity.

As mentioned, rapid automated naming refers to a commonly used task which measures one's ability to retrieve and produce phonological representations from long term memory (Scarborough & Brady, 2002; Wagner et al., 1997). This skill has also been referred to as phonological recoding for lexical access (Wagner & Torgesen, 1987; Wagner et al., 1987). This is the cognitive process of retrieving phonological codes for the linguistic unit from long-term memory, blending these codes together, and searching the reader's long-term memory internal dictionary to find meaning of the combined codes (Wagner et al., 1987). Researchers believe that when readers engage in this process of decoding, they carry out a variety of similar cognitive processes when rapidly naming stimuli such as letters, words, digits, colors, shapes or other objects (Nelson et al., 2012). The efficiency of these underlying cognitive processes in retrieving phonological codes for letters, word segments, and whole words are thought to influence the success with which a reader can use phonological information within the process of decoding (Bowers & Wolf, 1993).

Wagner and colleagues (1997) assert that enough evidence exists for the relationship between serial naming performance tasks and other phonological processing skills to be included as part of the assessment of phonological processing. Studies indicate that rapid naming accounts for about five to ten percent of the variance in decoding ability (Georgiou, Das, & Hayward, 2008; Høien-Tengesdal & Tonnessen, 2011; Parrila et al., 2004). Furthermore, Vandewalle and colleagues (2012) observed in their longitudinal study that children with language impairments and reading delays had lower rapid automated naming scores in kindergarten compared with typical early readers and suggest that rapid automated naming may

be a good predictor of later literacy delay. Perhaps Blachman (1994) summed up the importance of rapid naming best when she described a conversation with a personal colleague, F. Wood, who studied the importance of rapid naming. Blachman paraphrased what her colleague found in their longitudinal study:

“...children diverge in reading achievement in fifth grade according to their rapid naming proficiency. Thus, according to data, if you start out with a group of third graders, all of whom are low in phoneme awareness, the best predictor of reading achievement in fifth grade is rapid naming ability. Poor phoneme awareness may get the child into a remedial reading program, but also having a naming rate deficit may be what keeps the child in the program” (Blachman, 1994, pp.290)

***Models of phonological processing.*** Previous studies have investigated the factor structure of phonological processing, which include phonological awareness, phonological memory, and rapid automated naming (e.g., Høien-Tengesdal & Tonnessen, 2011; Nelson et al., 2012; Wagner & Torgesen, 1987; Wagner et al. 1987; Wagner et al., 1993; Wagner et al., 1997). While consensus in the literature exists that these three skills are important aspects of phonological processing, the specific theoretical model which comprise these three factors has yet to be determined, as many studies have found inconsistent factor structures. Some research supports that there is a specific ability model (Anthony, Williams, McDonald, & Francis, 2007; Nelson et al., 2012) which would indicate that phonological awareness, phonological memory, and rapid automated naming are all distinguishable abilities. Other research indicates a two factor model which combines phonological awareness and phonological memory as one factor with rapid automated naming serving as a second factor (Wagner et al., 1987; Wagner et al., 1993). Wagner and colleagues (1993) indicate that phonological awareness and phonological

memory may not be two distinctly different factors because both represent cognitive processes that are dependent upon one another. For example, all speech information is processed in phonological memory and it would be impossible to measure phonological awareness and phonological memory completely independently of one another (Nelson et al., 2012).

Furthermore, research indicates that each phonological processing skill accounts for varying degrees of variance in word decoding. For example, even though Nelson and colleagues (2012) found enough evidence to support a three factor model of phonological processing, their results found that phonological awareness and rapid automated naming explained unique variance in word recognition while phonological memory explained very little. Additionally, they found that phonological awareness accounted for significantly more unique variance than did rapid automated naming. Some recent evidence also suggests that phonological memory may actually contribute to decoding ability under the realm of phonological awareness (Soltani & Roslan, 2013) which is consistent with the finding that phonological awareness and phonological memory are highly dependent and related with one another (Clark, McRoberts, Van Dyke, Shankweiler, & Braze, 2012; Wagner et al., 1987; Wagner et al., 1993). The research is overwhelmingly consistent, however, that phonological awareness by far is the best phonological processing skill predictor of word decoding ability (e.g., Hester & Hodson, 2004; Høien-Tengesdal & Tonnessen, 2011; Juel et al., 1986; Nelson et al., 2012; Nithart et al., 2011; Soltani & Roslan, 2013; Wagner & Torgesen, 1987; Wagner et al. 1987; Wagner et al., 1993; Wagner et al., 1997).

**Orthographic processing.** Reading development is also contingent on the development of orthography and the visual process of recognizing words from memory. Orthography is the study and practice of representing sounds or words within a particular language by written or

printed symbols (Merriam-Webster's online dictionary, n.d.). Orton (1925) was one of the first researchers who raised the connection between orthographic processes and reading development when he proposed that reading difficulties were largely a result of "word-blindness", or poor visual processing. Evans and Drasdo (1990) reviewed various lines of research that have connected differing aspects of visual processing to reading and found some evidence for a variety of visual processing problems within individuals with reading disabilities such as visual acuity problems, refractive errors, binocular vision anomalies, eye movement, ocular pathology, and transient visual systems. While evidence exists of visual process deficits, researchers assert that the argument for poor visual processing as the sole source of reading disability is not warranted and rather that it is the inadequate command of grapheme-phoneme associations which play the most critical role in reading disabilities (Asskink, Lam, & Knuijt, 1998). What is not controversial, however, is that orthographic processing is indeed an essential component of the decoding process (Adams, 1990) and contributes some unique variance to word recognition independent of phonological processing (Barker, Torgesen, & Wagner, 1992; Cunningham, Perry, & Stanovich, 2001; Juel et al., 1986).

All orthographies, whether they are alphabetic, syllabic, or logographic, translate a spoken language into some kind of graphic form (Frost, 2005). Orthographic processing, therefore, is the ability to form, store, and retrieve orthographic representations from memory (Burt, 2006). The orthographic processor is critical to the development of letter-sound connections because the reader must recognize what the symbol (i.e., letter) is representing (i.e., phoneme) in order to begin the process of decoding an unknown word. The advantage of an alphabetic letter system, such as English, is that letters supply an individual with a mental symbol system for representing and thinking about specific phonemes (Hohn & Ehri, 1983).

However, all orthographic systems contain symbols or characters that represent units of sounds. A main difference between various orthographies is merely in the size of the linguistic units that the orthography represents (e.g., phonemes, syllables, morphosyllables) (Frost, 2005).

The visual representations of how a word is spelled within a particular alphabetic orthography have been found to facilitate memory recall of the word (Ehri & Wilce, 1979). When readers develop orthographic skill, they are able to recognize words directly on a visual basis (Backman, Bruck, Hebert, & Seidenberg, 1984). Evidence exists which indicates that skilled and well developed readers are able to automatically recognize a familiar word based on its visual or spelling patterns (Barker, Torgesen, & Wagner, 1992). For example, this orthographic knowledge allows a skilled reader to automatically recognize the pseudoword *trea* as a misrepresentation of the word *tree*, even though both words have identical phonological representations.

Another example of how spelling patterns can contribute to word recognition is through Glushko's (1979, 1981) model of word recognition. Glushko asserted that target words can be identified through associating known phonetic information from *orthographic neighbors*. For example the words *steam* and *beam* have an analogous grapheme (i.e., *eam*). If a reader has learned this grapheme, then the reader only needs to replace the beginning sound in order to read the target word. The term orthographic neighbor is related to terms that educators may use such as *word families*, *spelling patterns*, or *onset and rimes* (Foorman & Liberman, 1989). A spelling-based phonic word study technique that is often used to teach students to categorize words into particular families is called word sorts (Bear, Invernizzi, Templeton, & Johnston, 1996). This task requires the student to sort words into lists which contain similar spelling patterns in order to construct mental representations of orthographic neighbors. Word sorts have

been found to improve word reading ability as well as positively impact spelling performance (Joseph, 2000).

However, spelling patterns in many languages do not always have a clear one-to-one correspondence with the word's phonology (Beaton, Suller, Workman, 2007). For example, the English language is considered a deep orthography because similarly spelled graphemes are often used to represent different sounds (Frost, 2005). For example, *steal* and *stealth* have the same grapheme (i.e., *eal*) but the morpheme *ea* in each word represents two distinct phonemes. Sometimes similar phonemes are instead represented by different graphemes, such as the phoneme *ee* which is represented differently in *seem* and *team*. Similarly, the English language contains homophones, which are words that sound the same but have different spellings (e.g., *to*, *two*, and *too*). Additionally, a given letter string may spell a word that can be pronounced similarly but have different meanings and these are called homographs (e.g., *rose as in flower*; *rose as in past tense of rise*). In contrast, some languages (e.g., Serb-Croatian; Welsh) are considered to be a shallow orthography and words are more easily identified because the correspondence between spelling patterns and phonemes are one-to-one (Benuck & Peverly, 2004).

The degree of transparency and level of depth within orthographies are determined by two factors: *regularity* and *consistency* (Frost, 2005). Regularity refers to whether words can be decoded based on the most common grapheme-phoneme correspondence rules. Irregular words (e.g., *yacht*) cannot be pronounced by accessing simple decoding rules compared to regular words (e.g., *raft*) because these words do not include graphemes that represent the most common sounds of the letter combinations. Consistency involves the uniqueness of pronunciation of a particular grapheme (Frost, 2005). For example, because *cough* and *though* are pronounced

differently, the letter cluster *ough* is inconsistent. Languages that contain many words that are either irregular or inconsistent are considered to have deep orthographies.

The difference in depth between different orthographies may influence the extent to which decoding processing strategies are used (Beaton, Suller, Workman, 2007). For example, Ziegler, Perry, Jacobs, and Baun (2001) indicate that the words *ball*, *park*, and *hand* are represented identically in English and German. However, while the grapheme *a* is pronounced the same in all three words in German, it represents different phonemes in each of the three words in English. Ziegler et al. (2001) assert that because German is a more consistent orthography, and therefore shallower than English, readers of the German language process words by focusing on short linguistic units. English readers, on the other hand, must focus on processing larger linguistic units and contextual information to distinguish between graphemes that often represent different phonemes depending on other letter strings that surround a particular grapheme within a word. This notion is related to the orthographic depth hypothesis which suggests that shallow orthographies can better support a word recognition process that involves a language's phonology (Frost, 2005). Shallow orthographies allow a reader to more easily apply phonics rule generalizations to recognize a word while deeper orthographies rely more heavily on processing contextual information to aid in word recognition.

**Meaning processing.** Recognition of words through remembering patterns of letter clusters and mapping these clusters to phonology is not the end of the word recognition process. As mentioned, comprehension is the end goal of reading and related to this notion is that making meaning of words is the end goal of the word recognition process (Adams, 1990). When a reader recognizes a word's pattern of letter clusters it sends signals to the meaning processor to activate the semantic information from long term memory that is associated with the word

(Adams, 1990). Specifically, this process occurs within semantic memory, which contains information about words, concepts, facts, and the associations between words and concepts (Bruning, Schraw, Norby, & Ronning, 2004).

Concepts are acquired through experiences with objects and the attributes, or the similar features across examples of a concept, such as texture, color, size, and shape become encoded in the meaning processor (Adams, 1990; Bruning et al., 2004). The features that are essential to defining the concept would be referred to as defining attributes and these are more strongly encoded in the meaning processor (Bruning et al., 2004). For example, consider a toddler who is learning about dogs. Defining attributes of the dog might be that the dog has four legs, a tail, and generally moves fast compared to humans. Other attributes that may vary slightly in different breeds of dogs are size or whether the dog has fur or hair. More exposure to different breeds of dogs as well as to other animals that are similar will better reinforce the concept so that when a reader comes across the word *poodle*, it will automatically activate a mental image from the meaning processor as to what the word means.

Semantic information, however, not only is activated by data sent from the orthographic processor but it in fact aids the orthographic processor in recognizing words. For example, Evans, Ralph, and Wollams (2012) designed a study to display how semantic information supports the process of word recognition. Evans and colleagues gave undergraduate student participants two lists of both real word and non-word foils that were three to five letters in length and mono-syllabic. The first list contained 80 real words of which 40 were high-imageability words (e.g., FUR) and 40 were low-imageability (e.g., OWE). Additionally, the list contained 80 non-words of which 40 were high-imageability basewords (e.g., ZEW [from ZOO]) and 40 low-imageability basewords (e.g., FET). A second list of 80 real words and 80 non-words was

administered to participants which contained half that had related prime words next to the target word (e.g., wood- LOG; key- LOK) and half that had unrelated primes (e.g., oven- LIP; car- DET [from debt]). The participants were required to make a yes or no decision if the target words on each list were real words or non-words.

The researchers found that the semantic effects of image ability and semantic priming aided in word recognition decision speed (Evans et al., 2012). As decisions about whether a word was a real word became more challenging, semantic information about the conceptual image of a word and the meaning of word, which was activated by the semantic prime, increased significantly. These findings provide support for the notion that the meaning processor sends information back to the orthographic processor to decide if letter clusters represent real or non-words. This is critical to the word recognition process because if this did not occur, a reader might accidentally decode a word incorrectly and keep reading without the awareness that the word was not correctly recognized.

### **Theories of Word Recognition Development**

To explain the process of reading and word recognition, theories of reading development have been proposed which take into account the influence of the phonologic, orthographic, and meaning processing systems. These theories postulate the way in which the three processing systems develop to ultimately produce automatic and fluent word reading. The dual-route theory, connectionist theory, and stage models will be reviewed in this section. These influential models of literacy development have helped shape the way that scholars and practitioners conceptualize word recognition development.

The dual route theory proposes that word recognition development occurs because of two distinct pathways from word form to semantic meaning. The first pathway is from the

orthographic processor and this is a direct route to the semantic meaning of a word (Laszlo & Federmeier, 2007). This route involves accessing the printed word's meaning based on the visual features of the word such as the letters and combinations of letters that make up its composition (Lukaleta & Turvey, 1998). The other route is through the phonological processor which is more indirect and involves the transitional step of decoding words through converting graphemes to phonemes and eventually blending these phonemes together to pronounce the word (Lukaleta & Turvey, 1998). This rule-governed second route maps transparent orthography to phonology and from there word meaning is activated (Laszlo & Federmeier, 2007). In general, this theory proposes that if a word is familiar to a reader, the orthographic processor will automatically activate word recognition and word meaning (Orthography → Meaning), but if a reader comes across an unfamiliar word, word recognition must be activated through the more indirect and slower phonological route (Phonology → Orthography → Meaning).

The orthographic processing route has also been referred to as the lexical route because any word that can be recognized by the orthographic processor has an entry in the reader's internal mental lexicon (Coltheart, Curtis, Atkins, & Haller 1993). Baron and Strawson (1976) contend that this lexical route is necessary for recognition of words that cannot be decoded using typical phoneme-grapheme conversion rules. Additionally, this lexical access is believed to play a role in the recognition of meaning for non-alphabetic symbols (e.g., \$, @, %) that represent words for which no phonic conversion rules are available. The non-lexical route, which utilizes the phonological processor, allows a reader to successfully decode pronounceable non-words and words that obey typical phoneme-grapheme conversion rules but will deliver incorrect output if one is reading an exception word that does not follow typical phonic rules (Coltheart et al., 1993).

The dual route theory proposes that the orthographic and phonologic routes from print to meaning are two functionally separate pathways and entail different computations (Laszlo & Federmeier, 2007). In this model, the orthographic and phonologic routes function independent of one another. The connectionist model, in contrast to the dual route theory, proposes that information from the orthographic, phonologic, and meaning processors all flow freely within one another and these systems provide necessary feedback to each other to aid in the process of word recognition (Laszlo & Federmeier, 2007). Instead of thinking about orthography and phonology as separate systems used in certain situations (e.g., regular vs irregular words; familiar vs unfamiliar words), the connectionist model proposes that visual word recognition results in the activation of phonological information in parallel with orthographic representations (Seidenberg & McClelland, 1989). Seidenberg and McClelland (1989) argue that when children acquire word recognition skills, children learn to associate the orthographic codes for words with their meanings and pronunciations. Once word recognition skills are acquired, processing a written stimulus results in the activation of orthographic information, phonologic information, and semantic information of the word (Adams, 1990; Harm & Seidenberg, 2004; Seidenberg & McClelland, 1989).

Adams (1990) conceptualized word recognition skills by adopting this connectionist framework in her influential text of reading development. She explains that there are pathways that connect the orthographic processor to the phonologic processor and that there is a bi-directional relationship between both of these processors. When a reader comes across a word, the orthographic processor activates information about the phonology of the word and vice versa. Both the orthographic and phonologic processors are also connected to the meaning processor in a similar fashion. This is consistent with the aforementioned notion that all three processing

systems are activated and influenced by one another. Adams (1990) does note that it is only the orthographic processor that receives input directly from the printed page. When the printed visual information is processed, such as processing letter order or letter patterns, it then causes the system to activate the phonological and meaning processors. It is theorized by connection theorists that the activation of these three systems allows for words to be recognized most efficiently and fluently (Adams, 1990; Harm & Seidenberg, 2004; Seidenberg & McClelland, 1989).

Other theories of reading acquisition and word recognition have been proposed and are considered to be stage theories. These theories propose that word recognition skills are developed in a matter of specific and distinct developmental periods that must be passed through in order to develop fluent and automatic reading. These stage theories take into account orthographic processing and phonological processing and attempt to describe how these two systems develop. Three influential stage theories will be reviewed to describe how researchers have conceptualized word recognition development.

Gough and Hillinger (1980) developed a two-stage theory of word recognition development and asserted that learning to read is not an easy task for most children. They indicated that even average readers who score at the 50<sup>th</sup> percentile at the end of first grade on word reading tasks learn to read very slowly and with great difficulty. In order to explain these observations they outlined their stage model of word recognition development in their literature review. The two stages that are proposed in this model are the *Paired-Associate Learning* and *Cryptanalysis* stages.

The paired-associate learning stage of Gough and Hillinger's (1980) model involves the early reader encoding salient visual or graphic features about the word and then associating the

word's visual attributes with the desired correct pronunciation response for the target word. The word is thus identified as a whole image, rather than as a series of linguistic units such as syllables or phonemes. The entire process then would be reliant upon orthographic processing and memory to first recognize a distinctive physical feature of a target word, encode this feature into memory, and then retrieve the association from memory in order to recognize a particular word. For example, if a child was learning the word *play*, the child may remember that the word starts with a *p*, has a slanted character at the end of the word (i.e., *y*), and has two letters that resemble a vertical line and circle with a tail in the middle of the word. After noticing one or all of these characteristics, Gough and Hillinger (1980) asserted that the child will then need to retrieve the association from memory and read the printed word as the associated spoken word. The child in this stage has no ability to decode the word if it is not instantly recognized by the orthographic processor because the child has not yet developed the ability to recognize letter-sound correspondences.

The associative nature of this stage helps to explain how many children may learn certain words faster than others. For example, children may learn the words *burger*, *king*, *tops*, *dollar*, *general*, or *stop* before other words such as *train* or *cookie* because they may have been exposed to these words on signs outside a fast food restaurant, grocery store, retail store, or on a street. The experience of pairing these words with shopping, eating, or riding in a car likely makes the associations stronger than merely being told what a word is on a sheet of paper. Additionally, Gough and Hillinger (1980) indicate that other features of these words provide a context for word recognition such as word font and color of text. So, it may not be surprising that a child may be able to recognize the words *Burger* and *King* when presented together on a sign outside

the food restaurant but not be able to recognize these words in isolation and in regular font on a piece of paper.

During the Cryptanalysis stage, children begin to be able to utilize the phonics rules that teachers provided them to decode words and utilize letter-sound correspondences. Additionally, Gough and Hillinger (1980) indicate that it is during this stage that the reader is able to go above and beyond simple letter and sound correspondences and recognize when a word is irregular and decipher these words. Much like uncovering a secret code and translating it into simple text, new readers must learn the written code to recognize words and uncover their meaning. Because English is a deep orthography, learning phonics rules alone will not be enough to learn the 50,000 words adults can typically read (Gough & Hillinger, 1980). Instead, the authors indicate that they must problem solve with words and be able to recognize inconsistencies among linguistic units which comprise irregular words. In other words, in this stage Gough and Hillinger (1980) propose that early readers must learn how to decipher words in order to uncover the hidden reading code while using information about letter and sound correspondences that they were formally taught in school as well as to implicitly understand the reading code. Through experience, formal education, and maturation, Gough and Hillinger (1980) believe this process occurs in the Cryptanalysis stage.

Gough and Hillinger's (1980) model was helpful in proposing that children move through stages of reading and word recognition development. Additionally, their model of reading underscores a commonality of other stage theories that postulates that children enter at least two distinct stages in order to recognize the link between a word's orthographic representation and its meaning (Dixon, Stuart, & Masterson, 2002). Similar to Gough and Hillinger's (1980) model, Frith (1985) developed an influential model of word recognition which theorized that readers

enter three specific phases of word recognition. The first phase, named the *Logographic phase*, is similar to the paired associated learning stage of Gough and Hillinger's (1980) model and emphasized word recognition based on the salient graphic features of words, such as the first letter in a word which is most often the most salient feature. Frith (1986) contends that most of the time, the order of the other letters in a word do not matter so long the word resembles the initial stimulus that was initially associated with the learned word. Because words are identified as whole images in this phase, they are not analyzed at a deeper level such as attempting to determine letter sound correspondences.

The next two stages in Frith's (1985) model essentially comprises the Cryptanalysis stage in Gough and Hillinger's (1980) model but breaks the process into two distinct phases. The second stage in Frith's (1985) model is the *Alphabetic Phase*. During this stage, the child begins developing phonological awareness and utilizes their knowledge of phonology to decode words. Frith (1985). The alphabetic phase allows a child to utilize letter and sound correspondences to blend individual phonemes into words and *alphabetic* refers to letter-sound by letter-sound analysis. This stage allows a child to teach themselves new words as suggested by the self-teaching hypothesis (Juel & Minden-Cupp, 2000).

The last stage in Frith's (1985) model is named the *Orthographic Phase*. By orthographic, Frith is referring to "instant recognition of morphemic parts of words taking into account letter order, but not letter sound; rather, if any sound at all, it is the sound of morphemes or of whole words" (Frith, 1986, pp. 72). In this stage, the reader has become so automatic with recognizing letter and sound correspondences, the reader instantly recognizes larger linguistic units with ease. Additionally, this stage is analogous to the process that the dual-route theory proposes, in which words are recognized automatically through orthographic processing. For

example, a child might recognize the morphemes *com* and *edy* in the word *comedy*. They also would understand that the word *come* is pronounced slightly differently on its own. Lastly, the reader most likely would not even actively search out for morpheme sounds in words because the reader would recognize the entire sound of the word *comedy* as a whole word and would read it automatically.

Frith's (1985) model implies that the acquisition of word recognition is not gradual but instead takes place in these three stages in which the reader experiences a qualitative change in each stage. Additionally, Frith (1986) proposes that as the child moves on through the stages, they are building on top of already established reading strategies. So, the child is not starting from scratch for each new strategy but adds new strategies to their repertoire. For instance, if a child came across an irregular word such as *dolphin*, a logographic strategy of recognizing the word first could be utilized by remembering the feature "*dol*". Then, in the alphabetic stage the child may learn a phonic rule that explains how the phoneme *f* can be represented by the morpheme *ph* on occasion. Through using both of these strategies, a reader begins to encode this new irregular into their lexicon until the child then enters the orthographic stage and automatically recognizes this word.

Another influential stage theory which is similar to Frith's (1985) model is proposed by Ehri (1995). Much like Frith, Ehri (1995) contends that all words eventually become recognized by sight. In order to explain this process, Ehri (1995, 2005) theorizes that readers progress through four stages. Ehri (1995) acknowledges that two of her stages are similar to Frith's (1985) logographic and orthographic stages but she felt it was necessary to re-label them because they were slightly misleading and ambiguous. For example, Ehri (1995) indicates that the term *logographic* can be confused with mature readers of logographic languages, such as Chinese,

while the term *orthographic* is simply not explicit enough and does not inherently capture the process of consolidating letters into larger linguistic units with automaticity.

The first stage of Ehri's (1995) model is called the *Pre-Alphabetic Phase*. This is similar to the logographic and paired associated reading stages of the previous stage models discussed. Additionally, this process was earlier termed as visual cue reading by Ehri and Wilce (1985) and they found that pre-readers learned word spellings best when provided with a visual strategy compared to phonetic strategy. The reader in the pre-alphabetic phase does not have any knowledge of letter and sound correspondences, rather they use visual strategies as suggested by Gough and Hillinger (1980) and Frith (1985). Ehri (1995) also suggests, however, that children use additional context when reading words such as the golden arches on a McDonald's sign or the shape of a sign, such as the unique shape of a "stop" sign. Additionally, Ehri (1995) contends that because the reader in this stage does not understand letter-sound connections, pronunciations of words also can be variable and often reflect phrases that may mean the target word. For example, the word *vacation* may be read as *go on trip* or *Disney World*. Ehri (1995) contends that the lack of correspondence at the phoneme level but the equivalence at the semantic level indicates that during this phase of reading development, strong connections between visual cues and semantic meaning are present while very weak connections exist between phonetic connections and semantic meaning.

The second stage is called the *Partial Alphabetic Stage*. During this stage, children learn the names and sounds of letters and can use them to remember how to read words (Ehri, 2005). However, even though the reader has some knowledge of letter and sound correspondences in this stage, they often have difficulty with medial letters (Ehri, 1995). For example, they may confuse the words *dresser* and *deeper* because they have the same boundary letters but different

medial letters. Ehri (1995) contends that the reason why connections are so partial at the phase of reading development is because the reader has not yet become fluent with refined phonemic awareness tasks and they have difficulty identifying individual phonemes with automaticity. Additionally, they still lack full knowledge of the spelling system, especially vowels, which make identifying medial sounds in words particularly challenging (Ehri, 1995).

Within the third stage, the *Full Alphabetic Phase*, the reader becomes skilled at recognizing letter and sound correspondences (Ehri, 1995, 2005). These readers do not have marked difficulties identifying medial letter sounds in words and recognize all phonemes in words. For example, the reader would recognize that the six letters in *deeper* represent four distinct phonemes of /d/, /ee/, /p/, and /er/. Ehri (1995) indicates that one feature that distinguishes full alphabetic readers from partial alphabetic readers is that full alphabetic readers are able to more easily decode words that they have never read before. Full alphabetic readers also are able to identify words learned with automaticity simply by visual cues, much like Frith (1985) suggested in her orthographic stage.

Within the *Consolidated Alphabetic Phase*, which is the last stage of the model, Ehri (1995) theorizes that representations between letter and sound correspondences and word spellings has become solidified in the reader's memory system. Readers in this stage typically are able to identify a word by sight and if they come across an unknown word they are able to decode the word by processing larger linguistic units than the individual phoneme (Ehri, 2005). For example, a full alphabetic phase reader would need to segment the word *stand* by breaking apart the word into each phoneme (/s/, /t/, /a/, /n/, /d/). A consolidated alphabetic phase reader would be able to decode the word using syllables or sub-syllable units such as onset and rimes (/st/, /and/). Ehri (2005) contends that when a reader is able to identify larger linguistic units,

they are able to more easily decode multisyllabic words such as the word *interesting*. This is because fewer grapheme-phoneme connections are required to cement the word into memory. In the case of the word *interesting*, the number of connections is reduced to four syllabic units compared to 10 phoneme-grapheme connections.

Taken together, stage, dual route, and connectionist theories indicate that as readers develop letter and sound connections, they are better able to utilize phonological and orthographic information to decode unknown words. Within various stages of word recognition development, readers have differing orthographic and phonological abilities. As the phonological and orthographic processors develop, students are better prepared to learn phonic generalization rules which facilitate word recognition development (Adams, 1990). In order to help children succeed in uncovering the written code, assessment of early phonics skills is paramount in order to provide information to the educator about where the reader is functioning within these stages of word recognition development. This information will allow educators the ability to tailor instruction to the individual needs of the student.

### **Alphabetic Principle Scope and Sequence**

Phonics curricula are organized strategically to support a student's development of orthographic and phonological skills as well as their progression through the various developmental phases of word recognition. Phonics instruction begins after students have had explicit instruction in phonological and phonemic awareness. This allows a student to use their knowledge and awareness of the sounds of language to make letter sound connections to begin learning how to decode words (Beck, 2006). Beck (2006) indicates that early in the instructional sequence for teaching a letter-sound relationship, attention must be brought to the target in all positions in which the letter is found. For example, when teaching the letter *m*, the student must

understand that it makes the /m/ sound at the beginning of a word, such as *mop*, as well as the end of a word, such as *Tom*. Poor readers often do not decode medial and final graphemes in words well, so phonics instruction must focus on developing strong letter-sound correspondences before teaching more advanced alphabetic principle skills.

Research indicates that letters should not be taught in alphabetic order, but instead should be taught according to the most important, or most frequently observed, letter-sound correspondences within words (Fry, 2004). For instance, Fry (2004) indicates that in a sample of 17,310 words, the most common consonant letter sounds are *r*, *t*, *n*, *l*, and *s* while the most rare are *z*, *x*, *q*, and *y*. Phonics curricula, such as California Treasures (Macmillian/McGraw-Hill, 2013), Scott Foresman Reading Street (Pearson, 2011), and the New York State (NYS) Common Core modules (“Engage New York”, 2013) all introduce the most important and common letters to students first before teaching the rest of the alphabet. This strategic introduction of letter-sound connections scaffolds learning for the student so that they will likely be more successful in reading words that contain high frequency letter-sound correspondences.

Once students have learned basic letter-sound correspondences for both consonant and short vowel sounds in isolation and in one syllable CVC words, students begin learning more advanced phonics skills. For example, in the Ultimate Phonics Scope and Sequence, the next skills taught to students are initial and final consonant blends (Spencer Learning, 2010). Examples of consonant blends that are taught are *sl*, *st*, *sp*, *br*, *cr*, *dr*, *fr*, *pr*, *gr*, *cl*, *fl*, *sk*, *sw*, *nd*, *nt*, and *nt*. In total, 42 initial and final consonant blends are taught to students in this curriculum. This is similar to other phonics curricula such as Scott Foresman Reading Street, California Treasures, and the NYS Common Core. Commonly, the next most common phonics skill taught to students are consonant digraphs (e.g., “Engage New York”, 2013; Macmillian/McGraw-Hill,

2013; Pearson, 2011; Spencer Learning, 2010). Consonant digraphs, in contrast to consonant blends, do not maintain their individual phonemes and instead combine to represent a unique sound (e.g., /sh/). The next skill taught to students in the NYS Common Core (2013), Scott Foresman Reading Street (Pearson, 2011), and California Treasures (Macmillian/McGraw-Hill, 2013) are long vowel silent-e and vowel digraphs. Silent-e words are those that have a CVCe pattern, where the first vowel sound is long while the *e* is silent at the end of the word (e.g., *bike*). Vowel digraphs, such as *ai*, *ee*, *oa*, and *oi* are similar in that the first vowel sound is long while the second vowel is silent.

The previous skills mentioned (e.g., CVC, consonant blends, consonant digraphs, silent-e, vowel digraphs) are all commonly taught by the end of first grade (“Engage New York”, 2013; Macmillian/McGraw-Hill, 2013; Pearson, 2011; Spencer Learning, 2010). Within the NYS Common Core modules, all of these skills except vowel digraphs are introduced in kindergarten. Scott Foresman Reading Street (Pearson, 2011) is similar, however, long vowels are not taught until first grade. More advanced phonics skills are then taught in second grade in order to continue developing student’s decoding skills. For example, students begin learning to decode *r*-controlled vowels (e.g., *car*), vowel diphthongs (e.g., *oi* as in *oil*), irregularly spelled words (e.g., *one*; *said*), regularly spelled two syllable words with long vowels, words with common prefixes (e.g., *in-*; *un-*) and suffixes (e.g., *-ed*; *-ing*), and phonographs or word families (e.g., *ake*) (“Engage New York”, 2013; Macmillian/McGraw-Hill, 2013; Scott Foresman Reading Street, 2011; Spencer Learning, 2010).

### **Assessment of Alphabetic Principle and Decoding Skills**

Salvia, Ysseldyke, and Bolt (2010) define assessment within the context of schools as the process of collecting data to make decisions about students. Many types of decisions can be

made using assessment data and include screening, progress monitoring, instructional planning and modification, resource allocation, eligibility for special education services, program evaluation, and accountability decisions (Salvia et al., 2010). Assessment techniques and tools vary depending on the type of decision that will be made but generally include interviews with the target student and other informants, rating scales, direct observation, informal assessment procedures (e.g., work samples), professional judgment, and tests (Salvia et al., 2010; Sattler, 2008). Therefore, assessment is a dynamic process in which a practitioner synthesizes and considers information from multiple sources in order to ultimately make a wide range of decisions, each with varying degrees of importance. Within the academic area of reading, assessments are needed to help educators make the aforementioned decisions in the early grades to ensure that all students will become effective readers (Hosp & Fuchs, 2005).

**Traditional achievement and diagnostic testing.** Tests can be useful sources of data because they measure specific behavioral responses to predetermined item sets so that their performances can be compared to a normative comparison group or to set criterion (Salvia et al., 2010). For decisions that have significant consequences, such as determining eligibility for special education services, tests require high levels of reliability and validity. For these purposes, cognitive and achievement batteries such as the Woodcock Johnson Tests of Cognitive Abilities, 3<sup>rd</sup> Edition (WJ-COG; Woodcock, McGrew, & Mather, 2001) and Woodcock Johnson Tests of Achievement, 3<sup>rd</sup> Edition (WJ-ACH; Woodcock et al., 2001) or the Wechsler Intelligence Scales for Children, fourth edition (WISC; Wechsler, 2003) and Wechsler Individual Achievement Test, third edition (WIAT; Wechsler, 2010) are often administered to measure cognitive strengths and weaknesses, reading skills, and achievement in other academic areas. Cognitive and intelligence tests measure underlying latent cognitive constructs which are thought

to impact academic skills. The overall score on a cognitive test is used to predict one's performance on achievement tests and then compare this predicted score to their actual score. If a large discrepancy between predicted and actual scores exists in a particular achievement area, such as word decoding or reading fluency, then a student traditionally may be identified to have a specific learning disability in the achievement area and may be eligible to receive special education services (Lichtenstein, 2008).

Other norm-referenced diagnostic reading tests, such as the Woodcock Reading Mastery Test (WRMT; Woodcock, 2011) and the Early Reading Diagnostic Assessment (ERDA), are administered to students in these high stakes eligibility decisions to supplement reading data from achievement tests. These norm referenced diagnostic tests contain subtests which measure a broad range of skills within the Big Five areas of reading in order to provide more information about the student's overall reading development. For example, the recently updated version of the WRMT-III states in the user's manual that the test developers used the NRP's findings to link subtests to the Big 5 areas of reading in order to validate the test (Woodcock, 2011). These diagnostic and achievement tests may be initially useful in determining major skill area strength and weaknesses, such as phonemic awareness or alphabetic principle, but provides less information about specific sub-skills within each reading area.

Other norm-referenced diagnostic tests, in contrast, measure fewer reading skills, but do so with more depth. Given that these tests might provide more information about specific alphabetic principle skills, these tests can be useful in instructional planning decisions. For example, the Test of Word Reading Efficiency (TOWRE) measures decoding efficiency as well as sight word efficiency (Torgesen, Wagner, & Rashotte, 1999). The Phonics-Based Reading Test (PRT) is another test that measures decoding skills and follows a scope and sequence of

increasingly complex phonics skills from letter names and sounds, to short and long vowels, to multisyllabic words (Brownell, 2002). These tests are scored by converting raw scores to standard scores in order to compare performances to a normative sample.

Other diagnostic reading tests, in contrast, are considered criterion referenced tests and do not utilize a normative comparison group. Criterion measures instead utilize either formal or informal cut scores to determine whether or not a student's current performance is following a trajectory which would predict future success. For example, the Developmental Reading Assessment, K-3, second edition (DRA-2, K-3; Beaver & Carter, 2006) is a criterion referenced reading test that measures a variety of reading skills including alphabetic principle skills. Instead of comparing student performance to normative data, examinee scores are translated to a reading level and described in terms of *Intervention*, *Instructional*, *Independent*, and *Advanced*. Another example of a criterion test that measures alphabetic principle skills, including letter sounds, consonant blends, silent-e words, vowel digraphs, diphthongs, r-controlled vowels, two syllable, and multisyllable, is the Diagnostic Assessments of Reading, second edition (Roswell, Chall, Curtis, & Kearns, 2005). A criterion is provided for each subtest to indicate acceptable performance. The 95% Group Phonics Screener for Intervention (PSI; 95% Group Inc., 2013) is an example of an informal criterion referenced diagnostic tool that follows a similar alphabetic principle skill scope and sequence to the PRT. The PSI is scored using an informal percentage correct mastery criterion of 90% correct for each of the administered skill areas.

Each of the aforementioned norm-referenced and criterion referenced diagnostic tests take at least 20 minutes to administer and do not contain more than two alternate forms. The PSI measure is the most efficient diagnostic test, with administration times between five and 10 minutes, but little psychometric information is available regarding this instrument. Additionally,

the tests contain small item samples of several phonics sub-skills, which make it difficult to determine if specific phonics skills are improving with instruction. So, while these tests may be helpful in determining skills to target for instruction or intervention, they would not be ideal for use in universal screening or progress monitoring decisions. Additionally, many current researchers have argued that norm referenced achievement tests do not sufficiently align with skills that are taught within a curriculum (Fuchs & Deno, 1994) and this makes it challenging to determine whether or not students have indeed mastered the skills that were actually taught (Shapiro, 2004). Alignment between what is taught and what is tested is essential so that educators can make better decisions about what an individual has or has not learned. Another issue of curricular alignment within norm referenced achievement tests is that in order to cut down on the number of items on a test, an achievement test will sample only a few items across a large number of sub-skills in a particular domain. When this is done, alignment between the test and curriculum is lost because of the limited sampling for each skill and because some skills are completely omitted from the test (Hosp, Hosp, & Howell, 2007).

**Curriculum-based assessment.** In order to assess students more effectively, a movement within the field of education occurred in the late 1980's in response to the preference for assessing students on direct skills with materials from the curriculum. Curriculum-based assessment (CBA) became a model of assessing learners within the context of their local educational program (Tucker, 1985). Curriculum-based assessment has been defined as a procedure for determining the instructional needs of students based on the student's performance in the curriculum (Gickling & Thompson, 1985). It is the process of determining which skills a student has learned within a curriculum (Howell, Hosp, & Kurns, 2008). A primary goal of CBA is to eliminate the mismatch between the academic skills that are taught and the content which

appears on assessments (Gickling & Thompson, 1985; Tucker, 1985). Additionally, CBA attempts to understand at which part of the curriculum a student performs in an instructional range, mastery range, and frustrational range and then to provide instruction within an appropriate range of difficulty. Assessment in this framework is termed *functional* in that it is direct, multidimensional, repeatable, relevant to a specific issue, and leads to instruction (Hosp, 2008).

Curriculum-based assessment employs a behavioral paradigm, direct and precise measurement, alignment with the students' learning outcomes and curriculum, repeatable measurement that is sensitive to changes due to learning, and has high content validity (Howell et al., 2008). One form of CBA is mastery measurement (Fuchs & Deno, 1991) which is based on Gickling's instructional design conception of CBA (Shinn, Rosenfield, & Knutson, 1989). Test materials for mastery measurement are developed by the teacher, or taken directly from curricular materials, on the basis of a task analysis of the curriculum (Espin, Shin, & Busch, 2000). Sub-skills within a predetermined learning hierarchy are determined to be "mastered" if the student achieves a certain accuracy percentage (e.g., 90% accuracy) (Hosp et al., 2007). The assumption of CBA mastery measurement is that learning consists of a series of short term objectives or accomplishments and that one must master each sub-skill within a learning hierarchy to be proficient in the skill (Fuchs, 2004). When a student demonstrates mastery of a specific academic skill, the teacher then moves on to teach the next academic sub-skill within the learning hierarchy (Fuchs, 2004; Hosp et al., 2007).

A different form of CBA, called curriculum-based measurement (CBM), also emerged in the 1980's due to several technical difficulties associated with mastery measurement (Fuchs, 2004). For example, true mastery measurement contains only one sub-skill on each probe.

Fuchs (2004) argued that this type of testing could potentially be misleading because learners may perform differently on a measure if they are only tested on one specific skill. Fuchs (2004) indicated that struggling learners often can show competency on single skill probes when they know that each item on the probe conforms to a particular pattern such as probes with only CVC words. However, when the student is then given a unit test which contains multiple skills, they often perform poorly and demonstrate that they have, in fact, not mastered the individual sub-skills. This discrepancy in performance questions mastery measurement's primary assumption that a series of short-term accomplishments eventually leads to overall competence of a broad academic task, such as word recognition or oral reading fluency. Fuchs (2004) contends that mastery measurement can lead teachers to believe that the student has mastered a specific academic skill during the year based on the strong performance of the mastery measurement probe. However, when the student is tested with a more global assessment at the end of the year, the student often fails to display competency. To avoid this common pitfall, curriculum-based measurement (CBM) was developed as a more precise method of measurement of academic skills.

Curriculum-based measurement (CBM) is widely used for screening and progress monitoring purposes in the areas of reading, mathematics, written expression, and spelling (Deno et al., 2009). Curriculum-based measures formatively measure skill areas that are closely tied to curricula than traditional standardized achievement tests, have adequate reliability and validity, have standardized administration and scoring rules, are time efficient and cost effective, and have multiple equivalent forms (Deno, 2003). Curriculum-based measures also utilize local norms or criterion to determine proficiency on skills, rather than using an arbitrary percentage correct criterion score like in mastery measurement (Deno, 1985; Deno, 2003). This feature of

CBM offers a reference group for determining the magnitude of skill deficit. Additionally, if CBM tools are used within a preventative problem-solving model of service delivery, such as Response to Intervention (RtI), they can be used as an alternative assessment system for determining learning disability eligibility for special education services (Lichtenstein, 2008).

In contrast to measuring each specific sub-skill like in mastery measurement, CBMs typically fall in two categories: General Outcome Measures (GOMs) or Skills-Based Measures (SBMs) (Hosp, Hosp, & Howell, 2007). General Outcome Measures are used to sample performance on broad and important tasks that are complex in that the individual must apply a wide number of sub-skills to be successful. For example, oral reading fluency (ORF) is a GOM because in order for a student to read with fluency, the reader must be able to perform a variety of reading sub-skills such as phonics skills, vocabulary, syntax, and content knowledge (Hosp, et al., 2007). Hosp and Fuchs (2005) found evidence that would support ORF as a GOM as it successfully predicted decoding, word reading, and passage reading in grades one through four. Success or improvement on GOMs is assumed to reflect the improvement of sub-skills that are responsible for at least part of the production of the broad skill being measured.

The second form of CBM, SBMs, more explicitly measure multiple sub-skills on each assessment probe. A SBM is constructed by identifying scope and sequences within a curricula and then adequately sampling multiple skills on each probe that will be eventually taught throughout the curriculum (Hosp et al., 2007). The items on these assessment probes are not placed in the order in which they are taught or in order of complexity and the items could sample skills learned throughout an entire curriculum or sample skills learned in shorter periods of time (Hosp et al., 2007). Both GOMs and SBMs can be used for long term progress monitoring

because they will produce long acquisition slopes, as compared to mastery measurement profiles that have many peaks and valleys for each specific sub-skill assessed (Hosp et al., 2007).

The Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Kaminski & Good, 2011) and the AIMSweb system (AIMSweb, 2012) are widely used commercial CBM systems that measure all Big Five areas of reading. In terms of measuring growth in phonics and word decoding skills, the DIBELS system includes probes for letter naming fluency (LNF), initial sound fluency (ISF), and nonsense word fluency (NWF). Similarly, the AIMSweb system includes phonics CBM probes which measures LNF, letter sound fluency (LSF), and NWF (AIMSweb, 2012). Each of these measures for both systems include standardized instructions, have a scoring procedure of adding correct items for a total score, contain multiple equivalent forms, and only take one minute to administer. Both DIBELS and AIMSweb utilize criterion cut scores to determine performance on the measures, however, AIMSweb also offers a normative comparison option at various levels (i.e., national, school district, school, grade, and classroom).

One disadvantage of DIBELS and AIMSweb is that there is currently not a SBM of phonics skills beyond consonant-vowel-consonant (CVC) words. Nonsense Word Fluency, which, arguably, is more of a mastery measure since it measures only two very similar sub-skills, uses pseudowords to measure vowel-consonant (VC) and CVC words. However, other important phonics skills such as consonant blends, digraphs, long vowels, or multisyllabic words are not screened and cannot be progress monitored. This can present a problem for educators who are providing phonics instruction to students who have mastered naming letters and sounds, VC, and CVC words but who struggle with more complex phonics skills. Educators must either decide to use NWF or use teacher created mastery measures with unknown reliability or validity to determine mastery of phonics skills. Some educators may decide to use a GOM such as an

ORF passage, which measures how many words a student reads on a one minute oral reading passage. While reading fluency may improve due to phonics instruction, it will not provide specific feedback to teachers to guide phonics instruction specifically. Because none of these measurement options are ideal and have various limitations, there is currently a need for a CBM assessment tool to measure multiple phonic sub-skills for the purposes of screening, progress monitoring, and determining progression in word recognition development to guide instruction.

### **Summary**

Reading is an essential skill that all students must acquire to be successful and independent citizens in society. The NRP identified five main areas of reading which include early literacy skills (i.e., phonemic awareness, alphabetic principle), reading fluency, vocabulary, and reading comprehension. While reading comprehension is the end goal of reading, early literacy skills are the building blocks for future reading success. Word recognition is largely dependent on the development of decoding skills, which is the ability to exploit knowledge of the alphabetic principle to read unknown words. The extant literature reviewed indicates that the development of decoding skills and word recognition is complex and requires three main processing systems which include the phonological processor, orthographic processor, and meaning processor. These systems work in conjunction with one another to produce automatic recognition of words when readers develop strong phonic generalization rules. To utilize these rules, readers must first enter and progress through various stages of word recognition development. In the last stages of word recognition development, readers are able to identify words by sight, which frees up cognitive resources for the purposes of understanding and remembering what is read.

In order to ensure that students progress through these necessary stages, reading assessment tools are often utilized to make various educational decisions. Many reading assessment tools currently exist for use by practitioners and include norm referenced achievement tests, broad diagnostic tests, and narrow diagnostic tests. These tests are helpful for assessing overall strengths and weaknesses in reading, but are not ideal for use when making screening, progress monitoring, or instructional planning decisions. Curriculum-based assessment procedures have been used to replace traditional norm referenced achievement tests for these purposes. Mastery measurement is an example of CBA, however, limitations exist when using this approach with respect to long term progress monitoring ability and lack of known reliability and validity on teacher made assessments.

Curriculum-based measurement, in contrast, is another form of CBA that contains standardized scoring and administration procedures, multiple equivalent forms, known reliability and validity, and is cost effective (e.g., 1-3 minute long tests). Many CBMs exist for reading, however, currently there is no CBM tool available to measure multiple alphabetic principle skills for the use of screening or progress monitoring. The current study will attempt to fill this void by providing initial evidence of reliability and validity of a skills-based CBM tool for beginning alphabetic principle skills named *Phonics Curriculum-Based Measurement (P-CBM)*.

## Chapter III: Methods

### Participants

Two hundred and twenty five first grade students (117 males, 103 females) from two partnering school districts in rural western New York State were included in the study. In total, 36% of the sample ( $n = 81$ ) attended the first partnering school district while the remaining 64% of the sample ( $n = 144$ ) attended the second partnering school district. Both partnering school districts are comprised of differing levels of socioeconomic status, but are similar in terms of racial diversity. Specifically, according to the New York State school report cards website (<https://reportcards.nysed.gov/>), the first partnering school has a free and reduced lunch rate of 26% while the second partnering school district's free and reduced lunch rate is at 54%. In terms of racial diversity, both school districts are largely comprised of Caucasian students (92% and 93%, respectively). Additionally, school district one has three percent of students who are Asian, two percent Black or African American, and one percent Hispanic, American Indian, or biracial, while school district two has four percent of students who are Black or African American, two percent Hispanic, and one percent biracial.

### Measures

**Phonics curriculum-based measurement development.** In order to develop the test items on the Phonics Curriculum-Based Measurement (P-CBM) tool, orthographically legal pseudowords were developed for four basic alphabetic principal skills (i.e., CVC, *gat*; consonant blends, *blum*; consonant digraphs, *chab*; and long vowel silent-e, *mape*). CVC words were developed by pairing vowels and consonants together to create pseudowords words that resemble the Nonsense Word Fluency (NWF) measure. Consonant blend, consonant digraph and long vowel silent-e pseudowords were developed by either substituting a consonant or vowel within a

real word (e.g., *stop* → *stup*) or by logically pairing consonants and vowels together to create a legal nonsense word (e.g., *chem*). Once the stimulus pseudowords were created, they were then randomly ordered on each of three alternate forms by using a random number generator.

When developing the items for each probe, the quantity of consonant and vowel sounds on the probe was attempted to reflect Fry's (2004) study on phoneme-grapheme frequency correspondences based on a sample of 17,310 words. Fry (2004) found that there are more words with the grapheme-phoneme correspondence of *r* than *w*, so there are more pseudowords on each probe with the *r* phoneme-grapheme correspondence than the *w* correspondence. Given that there are over 30 consonant blends consisting of both initial blends (e.g., *st*, *bl*, *fr*) and final blends (e.g., *nd*, *rt*, *ld*), 17 blends were randomly selected to be included on each probe.

Additionally, each probe contained all possible consonant digraphs (i.e., *ch*, *ck*, *kn*, *ng*, *ph*, *sh*, *th*, *wh*, and *wr*) and long vowel silent-e words. Each probe also contains 51 single skill words (i.e., 18 CVC words (e.g., *nit*), 11 consonant blend words (e.g., *brap*), 11 consonant digraph words (e.g., *chet*), and 11 silent-e words (e.g., *tave*). Additionally, each probe contains nine mixed skill words on each probe which contain three consonant blend-consonant digraph pairings (e.g., *blick*), three consonant blend-silent-e pairings (e.g., *swape*), and three consonant digraph-silent-e pairings (e.g., *chote*). In total there are 60 items on each probe when combining the single skill and mixed skill words.

Standardized administration and scoring procedures were developed to resemble the administration and scoring rules of other CBM tools. Specifically, examiners introduced the P-CBM by reading standardized directions and prompted examinees to complete a series of sample items. These sample items are used to train the examinee on the response format of the test and allowed the examiner to ensure that the examinee understood the task. After the examiner read

the standardized directions and the examinee completed the sample items, the examiner presented the examinee with a sheet of 60 pseudowords and began timing the examinee for one minute.

Two separate scores are provided on the P-CBM. First, examinees receive credit for each Targeted Linguistic Unit (TLU) that is pronounced correctly. Consonant-vowel-consonant words, consonant blends, consonant digraphs, and silent-e vowels are color coded and highlighted in bold on the examiner form of the P-CBM and are considered TLUs. To receive credit for TLU, the examinee must produce the correct targeted unit. For example, if the target word is *flup*, the examinee must blend the targeted unit (i.e., *fl*) by either segmenting the sounds in the word (i.e., /f/ /u/ /p/; /f/ /up/; /flu/ /p/) or by correctly recoding the entire word (i.e., “*flup*”) to receive credit for TLU. Only the targeted unit (i.e., CVC words; consonant blend; consonant digraph; silent-e vowel) is scored while the rest of the sounds in the word are not scored when scoring for TLU. For example, if the examinee segments the previous target word as /f/ /ap/, the examinee still receives credit for TLU because they pronounced the TLU correctly. Second, if the examinee responds by recoding the target words by fluently saying the entire word correctly, they also receive points for the Whole Words Read (WWR) score. The total number of correct TLUs and WWRs are summed to create a total TLU score and total WWR score.

### **Criterion measures.**

**Nonsense word fluency.** AIMSweb Nonsense Word fluency (NWF) is a standardized CBM assessment tool that measures the decoding ability for vowel-consonant (VC) and consonant-vowel-consonant (CVC) pseudowords. The NWF measure provides an overall indication of how well students can use basic decoding skills to read short vowel sounds and

consonants (Hosp et al., 2007). To administer NWF, students are presented with a page of nonsense VC or CVC words and are asked to point to each letter and say the sound of each letter or read the entire pseudoword. The student is timed for one minute and to receive credit, the student must either produce the correct individual sounds (/l/ /a/ /t/) or read the whole word (/lat/) (Hosp et al., 2007; Ritchey, 2008). A total score is then calculated by summing the total correct letter sequences (CLS). In addition to summing CLS, data collectors in this study also coded the total number of recodes to provide a WWR score. The NWF scoring system provides fluency scores for the total number of correctly pronounced sounds as well as the total number of whole words read in one minute.

Nonsense Word Fluency has been shown to have adequate reliability for screening and progress monitoring purposes (Fuchs, Fuchs, & Compton, 2004; Good, Simmons, & Kame'enui, 2001; Speece, Mills, Ritchey, & Hillman, 2003). Specifically, reliability coefficients were in the .80 to .90 range. For example, over a two week period, Fuchs and colleagues (2004) found that test-retest reliability was .87.

Additionally, NWF has demonstrated concurrent and predictive validity with word reading in kindergarten and first grade ( $r = .60$  to  $.90$  range; Fuchs et al., 2004; Good et al., 2001; Speece et al., 2003). When testing English language learners, Vanderwood, Linklater, & Healy (2008) found that NWF scores had significant moderate correlations with curriculum-based measures in oral reading fluency (ORF; .65), curriculum-based measures in reading comprehension (MAZE; .54), and the California Achievement Test, Sixth Edition (.39). Kaminski and Good (1998) found even larger significant predictive validity coefficients between NWF and ORF after one week (.82) and one month (.83).

**95% Group Phonics Screener for Intervention.** The Phonics Screener for Intervention (PSI) is a diagnostic screening tool that allows educators to investigate specific basic and advanced phonics skill strengths and weaknesses. Specifically, the PSI is often used to determine which specific phonics skills an educator should target for instruction. The PSI is based on a scope and sequence of phonics skills that begins with isolated letter naming and ends with complex multisyllabic words in order to measure advanced phonics decoding skills. The PSI is divided into three sections which include basic phonics skills (e.g., letter/sound naming; CVC; consonant blends), advanced phonics skills (e.g., predictable vowel teams; unpredictable vowel teams; vowel-r), and multisyllable words (e.g., closed syllables; silent-e syllables and schwa; open syllables).

To administer the PSI, the examiner asks the examinee to name letters, letter sounds, and pseudowords that measure different phonics skills within the basic, advanced, and multisyllable skill sections. Each phonics skill area contains 10 pseudoword items and 10 real word items, and the examinee is evaluated by using an accuracy score criterion. Specifically, items are administered until the examinee demonstrates that they are not performing at mastery by scoring below the 90% criterion on both the pseudoword and real word items within a skill area. For the purposes of this study, a total raw score was calculated by adding the total number of correct responses on both the pseudoword and real word items for each of the administered sections on the PSI until the student reaches the ceiling rule for the test.

## **Procedures**

**Approval from partnering school district.** After approval by the author's dissertation committee and the Human Subjects Research Committee (HSRC), the first phase of the current study was to seek approval from partnering school districts to solicit student participation and

passive parental consent. Refer to Appendices A and B to review the cover letter and research request form sent to prospective partnering school districts. Two partnering school districts (i.e., partnering school district 1 and partnering school district 2) agreed to participate in the study after relevant school officials (i.e., superintendents; building principals) approved their school districts to participate. Shortly after this initial approval, the process of gaining entry and access to the school districts' elementary school, school psychologist, and teachers were initiated.

After a series of teleconferences and email correspondences with key staff members from each partnering school, the current author was granted access to teacher class lists and a data collection schedule was established. Passive informed consent letters were sent out to families one month prior to data collection (see Appendices C and D). Additionally, the investigator discussed the availability of other resources to make data collection efficient such as space for administration and availability of school psychology interns and/or practicum students to assist in data collection. Letters to first grade teachers were also mailed electronically to inform the faculty that their students would be tested by graduate research assistants (RAs) and dates of data collection were included in the letter. Refer to Appendix E and F to review teacher outreach letters for each partnering school district.

**Data collection training.** The researcher recruited graduate students in school psychology from a local graduate training program. In total, eight graduate RAs participated as data collectors in the current study. Two RA's were fourth year students completing a part-time internship at one of the partnering school districts while two RA's were completing first year practicum field work at the other partnering school district. In addition, the other four RAs were second year students either enrolled in the doctoral or specialist level programs. Of the eight RAs, six were enrolled in the doctoral program while two were enrolled in the master's degree

specialist program. Additionally, two RAs had earned a master's degree in school psychology prior to data collection. At the time of data collection, RAs had completed at least two courses in psychoeducational assessment and were familiar with the importance of standardization rules for administering and scoring tests. Six of the eight RAs had completed four courses in psychoeducational assessment in addition to a training workshop in the administration of curriculum-based measures.

In addition to the prerequisite coursework in psychoeducational assessment, the current author provided a four hour didactic training on the P-CBM, NWF, and PSI administration and scoring procedures. The training consisted of lecture, video examples, and applied activities. The RA's practiced administering and scoring sample P-CBM, NWF, and PSI assessments and inter-rater reliability data was collected for each of the measures to ensure that there was consistency in scoring across measures prior to data collection.

A seven year old, second grade female child, was used as a video model to demonstrate administration and scoring procedures during the training. Additionally, the video model provided a live scoring opportunity to obtain inter-rater reliability information among the RAs after training was completed. See Appendix G to review a copy of the audio and videotape parental consent form used for the video model participant.

**Data collection.** AIMSweb Nonsense Word Fluency (NWF) assessments are given three times per year in October, January, and May at the partnering school districts to screen and identify students who are in need of additional reading interventions. Data collection coincided with the winter NWF screening in January 2014. The RAs administered the NWF measure that each school was already going to administer and this data was shared with the schools for their use as well as for usage in the current study. Along with NWF, the RA's also administered the

PSI and P-CBM assessments to participants during the same testing session. While both partnering schools utilized the NWF data, partnering school district two also requested access to the PSI data to further assist the school in informing their provision of general education intervention services (e.g., determining need for remedial interventions; determining remedial intervention groups). The parental consent forms for both partnering school districts included a cover letter which outlined and explained what data each school district would be utilizing.

Additionally, all measures were counterbalanced to account for order effects. A list of administration orders was developed and then randomized by using a random number generator. The researcher then assigned administration orders to correspond with the alphabetized class lists provided by the partnering school districts (e.g., order #1 was assigned to the first participant on the class list; order #2 was assigned to the second participant on the list; etc).

During data collection, 16.88% of the sample (38 participants) was utilized to gather data for inter-rater reliability. For these participants, a lead RA administered each measure while a second RA observer independently scored the P-CBM. Both forms from each rater were then used to calculate the percentage of occurrence agreements for TLU and WWR scores. RA lead administrators and observers were assigned to one another based on their scheduled availability for data collection and class lists were randomly assigned to RA partner dyads.

### **Design/ Analysis**

A variety of approaches were used to establish the reliability of P-CBM, including inter-rater reliability and alternate forms reliability. Inter-rater reliability was calculated using a computational occurrence agreement percentage formula (House, House, & Campbell, 1981). Refer to Appendix K for the interobserver agreement chart that was used to code agreements and disagreements in scoring among the sub-sample of inter-rater reliability data obtained during

data collection. Alternate forms reliability was tested through using Pearson's  $r$  parametric test by correlating form A with B, B with C, and C with A. Additionally, to further investigate equivalency of forms, an analysis of variance (ANOVA) was conducted in order to determine if there were significant differences in performance across forms. Concurrent criterion-related validity was established by using Pearson's  $r$  parametric test to correlate the P-CBM scores with the criterion measures of the NWF and PSI measures, which are established measures of alphabetic principle skills.

## Chapter IV: Results

### **Inter-rater Reliability**

In order to determine the consistency of ratings across research assistant (RA) data collectors, inter-rater reliability was calculated by using a computational observer agreement formula. The percentage of occurrence agreement was calculated by taking the total number of occurrence agreements, divided by the total number of occurrence agreements in addition to total disagreements (see Appendix H). Each individual item on the measures was considered to be a separate observation. An occurrence agreement was coded for each item in which both RA raters notated a correct response. A disagreement was coded if either RA rater notated a correct response while the other rater notated an incorrect response. Percentages of occurrence agreement for each measure were then averaged in order to calculate a total percentage of occurrence agreement on the measures in order to determine the overall consistency of ratings by each data collector.

**Research assistant training.** To assess agreement at the conclusion of the RA data collection training, a total of 28 occurrence agreements were calculated for each of the measures based on all possible RA pairings. Standardized training videos were utilized which consisted of the current author testing a sample child participant for the purposes of creating a video model for training purposes. Specifically, the RAs scored a sample administration of Nonsense Word Fluency (NWF), 95% Group Phonics Screener for Intervention (PSI), and Phonics Curriculum-Based Measurement (P-CBM) based on the training video administrations. Each NWF, PSI, and P-CBM measure contained a percent occurrence agreement for every possible RA pairing on these measures. High occurrence agreement on each measure following the data collection

training would provide evidence that the RA's were consistent in their scoring of each measure, which would suggest that the data collected in the current study is reliable. The results indicated adequate interobserver agreement with a total range of mean percentages of agreement between 82.91% and 96.60% across the measures. Refer to Table 2 for mean occurrence agreement percentages as well as minimum and maximum percentage agreements for each measure.

**Data collection.** A sub-sample of participants ( $n = 38$ ) was used to gather inter-rater reliability during data collection. Percentages of occurrence agreement were calculated for all three alternate forms for both TLU and WWR. Additionally, a total TLU and WWR percentage agreement was calculated by averaging all occurrence agreement percentages for these scores across the three alternate forms. See Table 3 for mean occurrence agreement percentages as well as minimum and maximum percentage agreements. When combining TLU and WWR across all three alternate forms, a total mean TLU occurrence agreement percentage was found to be 90.44% while a total mean WWR occurrence agreement percentage was found to be 79.21%.

### **Alternate Forms Reliability**

To determine alternate forms reliability, Pearson's  $r$  parametric test was utilized to find correlations between Forms A, B, and C of the P-CBM. For descriptive statistics including means, standard deviations, and number of cases for TLU and WWR for each alternate form, please refer to Table 4. When analyzing the correlation coefficients, the TLU and WWR scores were strongly and positively correlated with one another across all three alternate forms at  $p < .001$ . All of the reliability coefficients across the P-CBM forms are above .90 which indicates that there is strong reliability across these parallel forms. Refer to Table 5 for a full review of alternate forms reliability coefficients.

In addition to using a correlational design, to further support equivalency of alternate forms, a one way between subjects analysis of variance (ANOVA) was performed to analyze mean differences on Form A, Form B, and Form C for the TLU score. Levene's test of homogeneity of variances indicates that homoscedasticity could be assumed  $F(2, 645) = .358, p = .699$ . Overall, the main effect of alternate form was not significant  $F(2, 647) = .713, p = .491$ , which indicates that there were no significant differences on mean TLU scores across all three forms. Additionally, an ANOVA was performed to analyze mean differences on Form A, Form B, and Form C for the WWR score. Levene's test of homogeneity of variances indicates that homoscedasticity could also be assumed for the WWR score  $F(2, 645) = .597, p = .551$ . Similarly to the TLU score, the main effect of alternate form was not significant for the WWR score  $F(2, 647) = .175, p = .840$ . These results provide further evidence that Form A, Form B, and Form C are equivalent due to there not being significant mean differences in TLU and WWR scores across these parallel forms.

### **Concurrent Validity**

To determine concurrent validity, the P-CBM was correlated using Pearson's  $r$  parametric test with established measures of alphabetic principle. The TLU and WWR scores of each alternate form of the P-CBM were first correlated with NWF's CLS and WWR. Refer to Table 4 for descriptive statistics including means, standard deviations, and total number of cases for the P-CBM, NWF, and PSI. Overall, moderate to strong correlations were found between P-CBM and the NWF and PSI criterion measures. Specifically, the NWF scores were positively correlated with the P-CBM between .79 and .89 while the PSI was correlated with both P-CBM scores between .53 and .60. Refer to Table 5 for a full summary of concurrent validity

coefficients. These results suggest that the P-CBM measures basic phonics skills, given that both the NWF and PSI are established measures of these academic skills.

## Chapter V: Discussion

The extant research literature indicates that the acquisition of decoding and word recognition skills is essential to future growth in reading development. For example, skilled readers have the ability to recognize words from sight, which allows them to read text with fluency and expression, which in turn facilitates reading comprehension (Cutting & Scarborough, 2006; Ehri, 2007). Likewise, the inability to develop word recognition and decoding skills is one of the primary causes of reading difficulties (Adams, 1990; Torgesen, 2002) and specific reading disorders such as dyslexia (Siegel, 2006). The current study investigated the initial reliability and validity of a measure of alphabetic principle entitled Phonics Curriculum-Based Measurement (P-CBM). Utilizing effective assessment tools to measure word recognition development is an essential aspect of scientifically-based practice and researchers have asserted that reading assessments are needed to accurately screen, diagnose, and progress monitor students in reading (Hosp & Fuchs, 2005).

The results of the current study indicate that the P-CBM had strong inter-rater reliability when obtaining the Targeted Linguistic Unit (TLU) score. The TLU score provides the examiner with a total overall raw score for the amount of consonant-vowel-consonant (CVC), consonant blend, consonant digraph, or silent-e units the examinee pronounced correctly. Each item on the P-CBM contained either one or two TLUs. The scoring procedures dictate that each TLU is scored independently, regardless of the accuracy in pronunciation of other TLUs or other phonetic units in the word. Overall, research assistant (RA) data collectors had a high percentage of total occurrence agreement on the TLU score across the three alternate forms.

The RA's also had adequate percentage occurrence agreement when scoring Whole Words Read (WWR), which is the total raw score for the total number of items recoded with

accuracy. To receive credit for WWR, the examinee must successfully recode the entire word with accuracy and fluency, including both the TLU as well as any other phonetic elements in the word. While the total percentage of occurrence agreement on WWR across the three alternate forms was adequate, the occurrence agreement percentage among RA's was lower than for the TLU. It seems likely that the WWR score had a lower percentage of occurrence agreement because it may be easier for multiple raters to agree on whether or not an examinee should receive credit for a TLU than to determine if a response was successfully recoded. For example, if the participant made a slight pause between sounds within a word, the RA's judgment of scoring an item as being successfully recoded may have varied more frequently compared to scoring for a TLU. Future trainings on the P-CBM should address this challenge and provide more opportunities for practice in discriminating recodes accurately. However, given the adequate to strong inter-rater reliability of P-CBM immediately following the RA training as well as during data collection, and that it only took one hour of the four hour training to train graduate students on this measure, future users of the P-CBM may find the ease of administration and scoring to be advantageous.

The current findings also indicate that the P-CBM had strong alternate-forms reliability across three parallel forms. Both the Targeted Linguistic Unit (TLU) and Whole Words Read (WWR) scores on each form had strong significant positive correlations, which suggest that examinee performance across the alternate forms is highly consistent and related with one another. Furthermore, an analysis of variance (ANOVA) was conducted to determine the presence of significant differences across alternate forms for both TLU and WWR scores. No significant differences for either score across the three alternate forms were present, which further suggests equivalency between the three alternate forms investigated in this study. Having

reliable alternate forms is critical to the utility of the P-CBM, given that the measure was designed to be a curriculum-based measure used to formatively assess basic alphabetic principle skills in order to make screening, progress monitoring, and instructional planning decisions.

In terms of concurrent validity, TLU and WWR scores on the P-CBM were significantly and strongly correlated with Nonsense Word Fluency (NWF) scores. Given that NWF is an established curriculum-based measure (CBM) of basic alphabetic principle skills, these findings suggest initial evidence that the P-CBM may also be a valid measure of basic alphabetic principle skills. The key difference between these two measures is that NWF is comprised solely of vowel-consonant (VC) and consonant-vowel-consonant (CVC) words. Additionally, CVC words on P-CBM are scored in such a way that the entire CVC word is considered to be the targeted unit of measurement. Based on this scoring procedure, no partial credit is given for CVC words on the P-CBM if sounds are correct at the phoneme level because all sounds must be correct to receive credit for TLU. Examinees also earn credit for WWR if the CVC word is recoded on the P-CBM. Thus, the P-CBM is a more advanced measure of basic alphabetic principle skills since NWF allows for partial scoring credit at the individual phoneme level rather than basing the scoring on performance at the word level. Given that these measures are correlated with one another, practitioners in the field may find it useful to use NWF as an initial measurement of basic letter- sound correspondences but then switch to using P-CBM as students become fluent at identifying basic CVC words.

The P-CBM was also moderately correlated with the 95% Group Phonics Screener for Intervention (PSI), which is an established informal criterion-based diagnostic screener which measures basic and advanced alphabetic principle skills. The PSI has two forms (i.e., Form A and Form B) which contain four parts (i.e., basic phonics, advanced phonics skills, multisyllabic

words, and sight words). For the purpose of the current study, only basic phonics skills was administered to participants because the sub-skills in alphabetic principle that are measured on the P-CBM also appear on the basic phonics skills section of the PSI. Because the PSI is significantly correlated with the P-CBM and also measures the same skills as the P-CBM, practitioners may find it useful to utilize the PSI as a diagnostic screening assessment to identify alphabetic principle skills to target during intervention, but then use the P-CBM as a progress monitoring tool to measure growth in these areas and response to academic intervention. However, upon further validation, the P-CBM has the potential to be a more efficient universal screening measure of basic alphabetic principle instruction due to the brief administration time needed and multiple parallel forms.

Taken together, the findings of the current study provide initial compelling evidence that the P-CBM may have the potential to be a reliable and valid curriculum-based measure (CBM), specifically a skills-based measure (SBM), of basic alphabetic principle skills upon further replication. Given evidence of strong reliability and validity, the P-CBM could be utilized for screening and progress monitoring given the brief and efficient nature of the measure, as well as the availability of alternate forms. Additionally, the P-CBM may be used to guide instructional decision making in terms of what particular skills to target during instruction or intervention. Given that the sub-skills (i.e., CVC, consonant blends, consonant digraphs, silent-e) on the examiner form are color coded, educators could easily determine which specific sub-skills to target for intervention.

Previous research indicates that the development of word recognition and decoding skills is complex and involves multiple underlying cognitive processes. The development of the phonological, orthographic, and meaning processing systems allows readers to integrate

auditory, visual, and semantic information in order to recognize a target word (Adams, 1990; Seidenberg & McClelland, 1989; Torgesen & Wagner, 1992). P-CBM was developed with the intent of providing functional information to educators about a reader's development of decoding skills. While this assessment cannot provide diagnostic data regarding the underlying cognitive development of the phonological, orthographic, and semantic processors, it provides a direct and formative assessment of a reader's word recognition and decoding skills. Poor performance on the P-CBM may suggest that intervention is necessary in early alphabetic principle skills due to poor word recognition development. By using a proactive approach with formative CBM measures, such as the P-CBM, early intervention in early literacy skills may prevent future difficulties in processing phonological, orthographic, or semantic information to recognize words.

However, some students fail to respond to academic instruction and remedial intervention in reading and may be referred to school psychologists as part of a comprehensive evaluation to determine eligibility for special education services. While federal special education law requires a full psychological evaluation (which typically includes norm-referenced or criterion-referenced standardized tests) be provided to students to rule-out learning problems as a result of a visual, hearing or motor disability, intellectual disability, emotional disturbance, cultural factors, environmental or economic disadvantage, or limited English proficiency (IDEA, 2004, 34 C.F.R, § 300.309), formative CBM progress monitoring data gathered prior to referral for the evaluation are often strongly considered. This is due to changes in federal law which no longer require the determination of a specific learning disability (SLD) in reading be predicated on the traditional discrepancy model to determine academic underachievement (IDEA, 2004; Kavale & Flanagan, 2007; Jacob, Decker, & Hartshorne, 2011). Instead, academic underachievement can be based

on CBM data within a preventative Response- to- Intervention framework (RTI) (Deno, 2003; Lichtenstein, 2008).

Therefore, upon further validation, the P-CBM may provide practitioners with an important piece of assessment data when evaluating students for a SLD in reading. The current study demonstrates that the P-CBM may meet Deno's (2003) criteria for CBM's, given the initial reliability and validity findings, standardized administration and scoring rules, administration and scoring efficiency of the measure, and multiple equivalent forms. Practitioners could use P-CBM to monitor growth in basic alphabetic principle skills when given remedial intervention within these skill areas. P-CBM likely would be more sensitive to growth in CVC, consonant blends, consonant digraphs, and silent-e words than other CBM's which do not explicitly measure these skills, such as NWF or Oral Reading Fluency (ORF). In the past, educators have relied on mastery measurement and often created their own informal tests to determine growth in specific sub-skills. However, this form of measurement presents problems such as unknown reliability and validity as well as difficulties in displaying consistent generalization of measured skills to a broader measure of achievement or general outcome measure (Fuchs, 2004). P-CBM seems to fill a needed void in the field for reliable and valid SBM's to measure specific alphabetic principle skills.

Again, P-CBM provides formative assessment data for specific basic alphabetic skills and practitioners should utilize other sources of data when making eligibility decisions. For example, diagnostic decision making would be out of the scope of utility of the P-CBM. Standardized norm or criterion-referenced achievement tests would be better suited to make these types of decisions in order to determine underlying deficits in cognitive functioning or to determine general areas of reading deficits. Traditional tests measuring intellectual functioning,

such as the Woodcock-Johnson Tests of Cognitive Abilities, 3<sup>rd</sup> Edition or Wechsler Intelligence Scale for Children, 4<sup>th</sup> Edition, may provide information regarding underlying cognitive deficits in phonological, orthographic, or semantic processing (Wechsler, 2003; Woodcock, McGrew, & Mather, 2001). Additionally, norm and criterion-referenced diagnostic reading tests may provide important information regarding general skill area deficits, which may relate to the Big 5 areas of reading (NRP, 2000). However, because the content tested on traditional standardized achievement tests often do not sufficiently align with a student's local curriculum (Fuchs & Deno, 1994; Shapiro, 2004), the importance of utilizing formative curriculum-based assessment information from CBM's as part of a multifaceted evaluation remains essential in SLD eligibility decisions.

### **Limitations**

Because the current study was conducted in two small school districts in western New York State, the findings may not generalize to students in other geographic regions of the country. Additionally, the participants attended schools located in a rural setting and the findings may not generalize to suburban or urban settings. Moreover, the sample consisted primarily of Caucasian students and had little ethnic, cultural, or linguistic diversity among the participants. Lastly, the participants in this study were specifically chosen to be first graders at the winter benchmark because at this point in the curriculum these skills have been taught and one would expect to see a fair amount of variability in performance which was a desired feature of the sample. However, educators may wish to administer the P-CBM to students in different grade levels and the current study cannot provide data on the reliability or validity in other grade levels. It would be important to attempt to replicate the findings of the current study within

different regions of the county, settings, diverse populations, and grade levels in order to establish the utility of the P-CBM among various demographics.

An additional limitation exists in the development of the P-CBM. Due to the nature of how the P-CBM was constructed, items which contain CVC, consonant blend, consonant digraph, or silent-e words were randomly ordered on P-CBM probes. Rather than developing a standardized order of presentation for the four basic alphabetic principle skills, items were randomly selected from the final item pool to create a random order. Due to this methodology, examinees may have an unequal number of opportunities to attempt items of each specific sub-skill in the beginning of the assessment. This is potentially problematic because their overall TLU or WWR score may not be representative of an overall poor performance on basic alphabetic principle skills. For example, despite the randomization of items, it is possible that there is a larger concentration of one type of alphabetic principle skill at the beginning of the assessment which may bias the interpretation of the total score because the score may be more indicative of a specific sub-skill deficit rather than a deficit in overall basic phonics skills.

Systematic error was also observed during the current study. Eighteen percent of the cases for the PSI data were coded as missing due to RA data collectors not following standardized administration guidelines. RAs were given standardized instructions to administer a certain number of items on the PSI in order to be able to accurately correlate the PSI with the P-CBM. However, in the 18.2% of missing cases, RAs discontinued testing too early. Upon qualitative inspection of the PSI protocol forms, it was found that in all of these cases the participant performed poorly on the P-CBM. This systematic error has the potential to bias the results of the current study since the correlation coefficients do not include data for many

students who had significant reading difficulties. Future studies should attempt to replicate the current findings that the P-CBM and PSI are moderately correlated with one another.

### **Future Research**

In addition, future studies should investigate criterion validity of the P-CBM with other measures of reading achievement including norm-referenced and criterion-referenced tests. Additionally, predictive validity studies should be investigated to determine whether the P-CBM could predict future reading achievement. For example, the P-CBM could be studied to determine if performance on the P-CBM accurately predicts oral reading fluency or reading comprehension in the future. Moreover, it would be interesting to study whether the P-CBM accurately predicts other variables such as state test scores, school GPA, or SLD diagnoses in reading. Future studies should also attempt to replicate both the alternate forms and inter-rater reliability results found within the current study. It would be helpful for future studies to also create additional alternate parallel forms to increase the P-CBM's utility for frequent progress monitoring. The aforementioned areas for future research fulfill Fuchs's (2004) first two stages of programmatic research in CBM's: Technical features of the static score and technical features of slope.

After these two stages of research are firmly established, studies should then move to Fuchs's (2004) last stage of programmatic research which includes investigating the instructional utility of the measure. Future studies should investigate the treatment validity of the P-CBM to determine if it leads to better decision making and student achievement. In other words, does using the P-CBM result in teachers actually making efficient screening, progress monitoring, and/or instructional planning decisions? Additionally, studies could compare the use of other

measures such as NWF or the PSI along with the P-CBM to determine if the P-CBM has better treatment validity than the other measures that are available to educators.

Lastly, future research could develop norms in order to allow practitioners to make comparisons to a standardized sample. Criterion cut scores could also be established in order to determine specific benchmarks for screening purposes. For example, fall, winter, and spring benchmark cut scores could be provided to practitioners so that student performance could be compared to the benchmark criterion to determine if the student's progress in basic alphabetic principle skills is on a trajectory toward future success in reading. Having normative or criterion comparisons would provide practitioners with information regarding the magnitude of difference in between a student and a reference group or benchmark criterion. Moreover, norms and/or criterion benchmark scores could facilitate appropriate goal setting either by using the criterion benchmark cut scores or by using a normative approach.

## **Conclusion**

Early literacy and reading skills are both important predictors to an individual's future success in school and employment settings (Moats, 1999). Moreover, poor reading performance in elementary school has been associated with future conduct problems and juvenile delinquency by age fifteen (Williams, 1994). Research supports the notion that scientifically-based instruction provides all students with the best opportunity to prevent future academic, behavioral, and vocational problems associated with poor reading skill acquisition. The current study provides initial evidence of reliability and validity of the P-CBM, which can be utilized to facilitate scientifically-based instruction through the use of repeated measurements of basic alphabetic principle skills. These formative measurements could be helpful in making screening, progress monitoring, or instructional planning decisions as well as providing pre-referral data to

school psychologists who are conducting special education eligibility evaluations for a specific learning disability in reading.

## References

- Adams, M. J. (1990). *Beginning to read: Thinking and learning about print*. Cambridge, MA: MIT Press.
- Aiken, L. R., & Groth-Marnat, G. (2006). *Psychological testing and assessment (12<sup>th</sup> ed.)*. Boston, MA: Pearson Education Group.
- AIMSweb (2012). *Test of Early Literacy Administration and Scoring Guide*. San Antonio, TX: Pearson Assessment
- Anthony, J. L., Lonigan, C. J., Driscoll, K., Phillips, B.M., & Burgess, S. R. (2003). Phonological sensitivity: A quasi-parallel progression of word structure units and cognitive operations. *Reading Research Quarterly*, 38, 470-487. doi: 10.1598/RRQ.38.4.3
- Anthony, J. L., Williams, J.M, McDonald, R., & Francis, D. J. (2007). Phonological processing and emergent literacy in younger and older preschool children. *Annals of Dyslexia*, 57, 113-137. doi: 10.1007/s11881-007-0008-8
- Armbruster, B.B., Lehr, F., & Osborn, J. (2003). *Put reading first: The research building blocks for teaching children to read kindergarten through grade 3*. Jessup, MD: National Institute for Literacy.
- Assink, E., Lam, M., & Knuijt, P. (1998). Visual and phonological processes in poor readers' word recognition. *Applied Psycholinguistics*, 19, 471-487. doi: 10.1017/S0142716400010286

- Backman, J., Bruck, M., Hebert, M., & Seidenberg, M. S. (1984). Acquisition and use of spelling-sound correspondences in reading. *Journal of Experimental Child Psychology*, 38, 114-133. doi: 10.1016/0022-0965(84)90022-5
- Baddeley, A. D. (1982). Reading and working memory. *Bulletin of the British Psychological Society*, 35, 414-417. Retrieved from <http://www.bps.org.uk/>
- Baddeley, A. D. (1992). Working memory. *Science*, 255, 556-559. doi: 10.1126/science.1736359
- Baddeley A. D., & Hitch, G. J. (1974). Working memory. In *The Psychology of Learning and Motivation: Advances in Research and Theory*, ed. GA Bower, pp. 47–89. New York: Academic
- Barker, T. A., Torgesen, J. K., & Wagner, R. K. (1992). The role of orthographic processing skills on five different reading tasks. *Reading Research Quarterly*, 27, 335-345. doi: 10.2307/747673
- Bear, D. R., Invernizzi, M. A., Templeton, S., & Johnston, F. (1996). *Words their way: Word study for phonics, vocabulary, and spelling*. Englewood Cliffs, NJ: Prentice Hall.
- Beaton, A. A., Suller, S., & Workman, L. (2007). Visual laterality effects in readers of a deep and a shallow orthography. *Laterality*, 12, 199-215. doi: 10.1080/13576500601112283
- Beaver, J. & Carter, M. (2006). *Developmental reading assessment, second edition*. San Antonio, TX: Pearson Assessment
- Benuck, M. B., & Peverly, S. T. (2004). The effect of orthographic depth on reliance upon semantic context for oral reading in English and Hebrew. *Journal or Research in Reading*, 27,281-299. Retrieved from <http://onlinelibrary.wiley.com/journal/10.1111/%28ISSN%291467-9817>

- Bowers, P. G., & Wolf, M. (1993). Theoretical links among naming speed, precise timing mechanisms and orthographic skill in dyslexia. *Reading and Writing: An Interdisciplinary Journal*, 5, 69-85. doi: 10.1007/BF01026919
- Brownell, R. (2004). *Phonics-Based Reading Test*. Novato, CA: Academic Therapy Publications.
- Burt, J. S. (2006). What is orthographic processing skill and how does it relate to word identification in reading? *Journal of Research in Reading*, 29, 400-417. doi: 10.1111/j.1467-9817.2006.00315.x
- Carnine, D. W., Silbert, J., Kame'enui, E. J., & Tarver, S. G. (Eds.). (2004). *Direct instruction reading*. (4<sup>th</sup> ed.) Upper Saddle River, NJ: Pearson.
- Clark, N. B., McRoberts, G. W., Van Dyke, J. A., Shankweiler, D. P., & Braze, D. (2012). Immediate memory for pseudowords and phonological awareness are associated in adults and pre-reading children. *Clinical Linguistics & Phonetics*, 26(7), 577-596. doi: 10.3109/02699206.2012.673045
- Coltheart, M., Curtis, B., Atkins, P., & Haller, M. (1993). Models of reading aloud: Dual-route and parallel-distributed processing approaches. *Psychological Review*, 100(4), 589-608. doi: 10.1037/0033-295X.100.4.589
- Cunningham, A. E., Perry, K. E., & Stanovich, K. E. (2001). Converging evidence for the concept of orthographic processing. *Reading and Writing: An Interdisciplinary Journal*, 14, 549-568. doi: 10.1023/A:1011100226798
- Cutting, L. E. & Scarborough, H. S. (2006). Prediction of reading comprehension: Relative contributions of word recognition, language proficiency, and other cognitive skills can

- depend on how comprehension is measured. *Scientific Studies of Reading*, 10, 277-299.  
doi: 10.1207/s1532799xssr1003\_5
- Deno, S. L. (1985). Curriculum-based measurement: The emerging alternative. *Exceptional Children*, 52, 219-232. Retrieved from <http://journals.cec.sped.org/>
- Deno, S. L. (2003a). Curriculum-based measures: Development and perspectives. *Assessment for Effective Intervention*, 28, 3-12. doi: 10.1177/073724770302800302
- Deno, S. L., Reschly, A. L., Lembke, E. S., Magnusson, D., Callender, S. A., Windram, H., & Stachel, N. (2009). Developing a school-wide progress monitoring system. *Psychology in the Schools*, 46(1), 44-55. Retrieved from <http://onlinelibrary.wiley.com/journal/10.1002/%28ISSN%291520-6807>
- Deno, S. L. (2003b) Developments in curriculum-based measurement. *The Journal of Special Education*, 37, 184-192. Retrieved from <http://sed.sagepub.com/>
- Dixon, M., Stuart, M., & Masterson, J. (2002). The relationship between phonological awareness and the development of orthographic representations. *Reading and Writing: An Interdisciplinary Journal*, 15, 295-316. doi: 10.1023/A:1015200617447
- Ehri, L. C. (1995). Phases of development in learning to read words by sight. *Journal of Research in Reading*, 18, 116-125. doi: 10.1111/j.1467-9817.1995.tb00077.x
- Ehri, L. C. (2005). Learning to read words: Theory, findings, and issues. *Scientific Studies of Reading*, 9, 167-188. doi: 10.1207/s1532799xssr0902\_4
- Ehri, L. C. (2007). Development of sight word reading: Phases and findings. In M. J. Snowling & C. Hulme (Eds.) *The Science of Reading: A Handbook*. (pp. 135- 154). Malden, MA: Blackwell

- Ehri, L. C., & Wilce, L. S. (1979). The mnemonic value of orthography among beginning readers. *Journal of Educational Psychology, 71*, 26-40. doi: 10.1037/0022-0663.71.1.26
- Ehri, L. C., & Wilce, L. S. (1985). Movement into reading: Is the first stage of printed word learning visual or phonetic? *Reading Research Quarterly, 20*, 163- 179. doi: 10.2307/747753
- Engage New York (2013). *New York State common core curriculum and assessments*. Retrieved from <http://www.engageny.org/>
- Evans, B. J. W., & Drasdo, N. (1990). Review of ophthalmic factors in dyslexia. *Ophthalmic and Physiological Optics, 10*(2), 123-132. doi: 10.1111/j.1475-1313.1990.tb00965.x
- Evans, G. A. L., Ralph, M. A. L., & Woollams, A. M. (2012). What's in a word? A parametric study of semantic influences on visual word recognition. *Psychonomic Bulletin & Review, 19*, 325-331. doi: 10.3758/s13423-011-0213-7
- Foorman, B. R., & Liberman, D. (1989). Visual and phonological processing of words: A comparison of good and poor readers. *Journal of Learning Disabilities, 22*, 349-355. doi: 10.1177/002221948902200605
- Frith, U. (1985). Beneath the surface of developmental dyslexia. In K. Patterson, J. Marshall, & M. Coltheart (Eds.), *Surface dyslexia* (pp. 301-330). London: Erlbaum.
- Frith, U. (1986). A developmental framework for developmental dyslexia. *Annals of Dyslexia, 36*, 69-81. doi: 10.1007/BF02648022
- Frost, R. (2005). Orthographic systems and skilled word recognition processes in reading. In M. Snowling C. Hulme (Eds.) *The science of reading: A handbook*. (pp. 272-295) Malden: Blackwell Publishing.

- Fry, E. (2004). Phonics: A large phoneme-grapheme frequency count revised. *Journal of Literacy Research, 36*(1), 85-98. Retrieved from <http://jlr.sagepub.com/content/36/1/85.refs>
- Fuchs, L. S. (2004). The past, present, and future of curriculum-based measurement research. *School Psychology Review, 33*(2), 188-192. Retrieved from <http://www.nasponline.org/publications/spr/index.aspx?vol=42&issue=4>
- Fuchs, L. S. & Deno, S. (1991). Paradigmatic distinctions between instructionally relevant measurement models. *Exceptional Children, 57*(6), 488-499. Retrieved from <http://journals.cec.sped.org/ec/>
- Fuchs, L. S. & Deno, S. L. (1994). Must instructionally useful performance assessment be based in the curriculum? *Exceptional Children, 61*(1), 15-24. Retrieved from <http://journals.cec.sped.org/ec/>
- Fuchs, L. S., Fuchs, D., & Compton, D. L. (2004). Monitoring early reading development in first grade: Word identification fluency versus nonsense word fluency. *Exceptional Children, 71*, 723. Retrieved from <http://journals.cec.sped.org/ec/>
- Gathercole, S. E., Willis, C., & Baddeley, A. D. (1991). Differentiating phonological memory and awareness of rhyme: Reading and vocabulary development in children. *British Journal of Psychology, 82*, 387-406. doi: 10.1111/j.2044-8295.1991.tb02407.x
- Georgiou, G. K., Das, J. P., & Hayward, D. V. (2008). Comparing the contribution of two tests of working memory to reading in relation to phonological awareness and rapid naming speed. *Journal of Research in Reading, 31*, 302-318. doi: 10.1111/j.1467-9817.2008.00373.x

- Glushko, R. J. (1979). The organization and activation of orthographic knowledge in reading aloud. *Journal of Experimental Psychology: Human Perception and Performance*, 5, 674-691. doi: 10.1037/0096-1523.5.4.674
- Glushko, R. J. (1981). Principles for pronouncing print: The psychology of phonology. In A.M. Lesgold & C.H. Perfetti (Eds.), *Interactive Processes in reading* (pp.61-84). Hillsdale, NJ: Erlbaum.
- Goldstein (1976). Cognitive-linguistic functioning and learning to read in preschoolers. *Journal of Educational Psychology*, 68, 680-688. doi: 10.1037/0022-0663.68.6.680
- Good, R. H., Simmons, D. C., & Kame'enui, E. J. (2001). The importance and utility of a continuum of fluency based indicators of Foundational reading skills for third-grade students. *Scientific Studies of Reading*, 5, 257-288. doi: 10.1207/S1532799XSSR0503\_4
- Gough, P. B., & Hillinger, M. L. (1980). Learning to read: An unnatural act. *Bulletin of the Orton Society*, 30, 179- 196. doi: 10.1007/BF02653717
- Habib, M. (2000). The neurological basis of developmental dyslexia: An overview and working hypothesis. *Brain*, 123, 2373-2399. doi: 10.1093/brain/123.12.2373
- Harm, M. W., & Seidenberg, M. S. (2004). Computing the meanings of words in reading: Cooperative division of labor between visual and phonological processes. *Psychological Review*, 111, 662-720. doi: 10.1037/0033-295X.111.3.662
- Hester, E., & Hobson, B. W. (2004). The role of phonological representation in decoding skills of young readers. *Child Language Teaching and Therapy*, 20(2), 115-133. Retrieved from <http://clt.sagepub.com/>

- Hohn, W. E. & Ehri, L. C. (1983). Do alphabetic letters help prereaders acquire phonemic segmentation skill? *Journal of Educational Psychology*, 75, 752-762. Retrieved from <http://psycnet.apa.org/journals/edu/>
- Høien-Tengesdal, I. & Tonnessen, F. E. (2011). The relationship between phonological skills and word decoding. *Scandinavian Journal of Psychology*, 52, 93-103. doi: 10.1111/j.1467-9450.2010.00856.x
- Hosp, M. K. & Fuchs, L. S. (2005). Using CBM as an indicator of decoding, word reading, and comprehension: Do the relations change with grade? *School Psychology Review*, 34, 9-26. Retrieved from [http://www.researchgate.net/journal/02796015\\_School\\_psychology\\_review](http://www.researchgate.net/journal/02796015_School_psychology_review)
- Hosp, M. K., Hosp, J. L., & Howell, K. W. (2007). *The ABCs of CBM: A practical guide to curriculum-based measurement*. New York, NY: The Guilford Press.
- Hosp, M. K. & MacConnell, K. L. (2008). Best practices in curriculum-based evaluation in early reading. In A. Thomas & J. Grimes (Eds.) *Best Practices in School Psychology V*. (pp. 377- 396). Bethesda, MD: NASP.
- House, A. E., House, B. J., & Campbell, M. B. (1981). Measures of interobserver agreement: Calculation formulas and distribution effects. *Journal of Behavioral Assessment*, 3(1), 37-57. Retrieved from [http://www.researchgate.net/journal/01640305\\_Journal\\_of\\_Behavioral\\_Assessment](http://www.researchgate.net/journal/01640305_Journal_of_Behavioral_Assessment)
- Jacob, S., Decker, D. M., & Hartshorne, T. S. (2011). *Ethics and law for school psychologists* (6<sup>th</sup> ed.). Hoboken, NJ: John Wiley & Sons, Inc.

- Juel, C., Griffith, P., & Gough, P. (1986). Acquisition of literacy: A longitudinal study of children in first and second grade. *Journal of Educational Psychology, 78*, 243-255. Retrieved from <http://psycnet.apa.org/journals/edu/>
- Juel, C., & Minden-Cupp, C. (2000). Learning to read words: Linguistic units and instructional strategies. *Reading Research Quarterly, 35*, 458-492. doi: 10.1598/RRQ.35.4.2
- Joseph, L. M. (2000). Developing first-graders' phonemic awareness, word identification, and spelling: A comparison of two contemporary phonic approaches. *Reading Research and Instruction, 39*, 160-169. Retrieved from <http://www.tandfonline.com/loi/ulri20#.Un6qmuJsuSo>
- Joseph, L. M. (2006). Understanding, assessing, and intervening on reading problems: A guide for school psychologists and other educational consultants. Bethesda, MD: NASP.
- Kaminski, R., & Good, R. H. (1998). Assessing early literacy skills in a problem solving model: Dynamic indicators of basic early literacy skills. In M. Shinn (Ed.), *Advanced application of curriculum-based measurement* (pp. 113–142). New York: Guilford.
- Kaminski, R. A., & Good, R. H. (2011). *Dynamic Indicators of Basic Early Literacy Skills* (DIBELSnext). Eugene, OR, Dynamic Measurement Group.
- Katz, L., & Frost, R. (1992). The reading process is different for different orthographies: The orthographic depth hypothesis. *Haskins Laboratory Status Report, 147-160*. doi: 10.1016/S0166-4115(08)62789-2
- Katzir, T., Lesaux, N. K., Kim, Y. S. (2009). The role of reading self-concept and home literacy practices in fourth grade reading comprehension. *Reading and Writing: An Interdisciplinary Journal, 22*, 261-276. doi: 10.1007/s11145-007-9112-8

- Kavale, K. A. & Flanagan, D. P. (2007). Ability-achievement discrepancy, response to intervention, and assessment of cognitive abilities/processes in specific learning disability identification: Toward a contemporary operational definition. In S. R. Jimerson, M. K. Burns, & A. M. VanDerHeyden (Eds.), *Handbook of response to intervention: The science and practice of assessment and intervention*. (pp. 130–147). New York: Guilford.
- Kibby, M. Y. (2009). There are multiple contributors to the verbal short-term memory deficit in children with developmental reading disabilities. *Child Neuropsychology*, *15*, 485-506. doi: 10.1080/09297040902748218
- Laszlo, S., & Federmeier, K. D. (2007). Better the DVL you know: Acronyms reveal the contribution of familiarity to single-word reading. *Psychological Science*, *18*(2), 122-126. doi: 10.1111/j.1467-9280.2007.01859.x
- Liberman, I. Y. (1973). Segmentation of the spoken word and reading acquisition. *Bulletin of the Ortin Society*, *23*, 65-77. doi: 10.1007/BF02653842
- Liberman, I. Y., Shankweiler, D., Fischer, F.W., & Carter, B. (1974). Explicit syllable and phoneme segmentation in the young child. *Journal of Experimental Child Psychology*, *18*, 201-212. Retrieved from <http://www.journals.elsevier.com/journal-of-experimental-child-psychology/>
- Lichtenstein, R. (2008). Best practices in identification of learning disabilities. In A. Thomas & J. Grimes (Eds.), *Best practices in school psychology V*. (pp. 295–318). Bethesda, MD: NASP

- Lonigan, C. J. (2006). Development, assessment, and promotion of preliteracy skills. *Early Education and Development*, 17(1), 91 – 114. Retrieved from <http://www.tandfonline.com/loi/heed20#.Un6pe-JsuSo>
- Lukatela, G., & Turvey, M. T. (1998). Reading in two alphabets. *American Psychologist*, 53, 1057-1072. Retrieved from 10.1037/0003-066X.53.9.1057
- Mather, N., & Woodcock, R. W. (2001). *Examiner's Manual. Woodcock-Johnson III Tests of Achievement* (3<sup>rd</sup> ed.). Itasca, IL: Riverside Publishing.
- Macmillian/ McGraw-Hill (2013). *California treasures reading program*. New York, NY: Macmillian/ McGraw-Hill
- Moats, L. C. (1999). *Teaching reading is rocket science: What expert teachers of reading should know and be able to do*. Washington, DC: American Federation of Teachers.
- Moats, L. (2007). *Whole language high jinks: How to tell when 'scientifically-based reading instruction' isn't*. Washington, DC: Thomas B. Fordham Institute.
- National Reading Panel (2000). *Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction. Reports of the subgroups*. (No. NIH Pub. 00-4769). Washington DC: US Department of Health Service, National Institutes of Health, National Institute of Child Health and Human Development.
- Nelson, J. M., Lindstrom, J. H., Lindstrom, W., & Denis, D. (2012). The structure of phonological processing and its relation to basic reading. *Exceptionality*, 20, 179-196. doi: 10.1080/09362835.2012.694612
- Nithart, C., Demont, E., Metz-Lutz, M. N., Majerus, S., Poncellet, M., & Leybaert, J. (2011). Early contribution of phonological awareness and later influence of phonological

- memory throughout reading acquisition. *Journal of Research in Reading*, 34(3), 346-363.  
doi: 10.1111/j.1467-9817.2009.01427.x
- Orthography. (n.d.). In *Merriam-Webster's online dictionary* (11<sup>th</sup> ed.) Retrieved from  
<http://www.merriam-webster.com/dictionary/orthography>
- Orton, S. T. (1925). "Word-blindness" in school children. *Archives of Neurology and Psychiatry*, 14, 581-615. Retrieved from <http://archneurpsyc.jamanetwork.com/issues.aspx>
- Parrila, R., Kirby, J. R., & McQuarrie, L. (2004). Articulation rate, naming speed, verbal short-term memory, and phonological awareness: Longitudinal predictors of early reading development? *Scientific Studies of Reading*, 8(1), 3-26. Retrieved from  
<http://www.tandfonline.com/loi/hssr20#.Un6oSOJsuSo>
- Pearson (2011). *Scott Foresman Reading Street*. San Antonio, TX: Pearson Assessment
- Pufpaff, L. A. (2009). A developmental continuum of phonological sensitivity skills. *Psychology in the schools*, 46 (7), 679- 691. doi: 10.1002/pits.20407
- Ramachandra, V., Hewitt, L. E., & Brackenbury, T. (2011). The relationship between phonological memory, phonological sensitivity, and incidental word learning. *Journal of Psycholinguistic Research*, 40, 93-109. Retrieved from  
<http://www.springer.com/psychology/journal/10936>
- Rasinski, T. V. (2000). Speed does matter in reading. *The Reading Teacher*, 54, 146-151.  
Retrieved from <http://onlinelibrary.wiley.com/journal/10.1002/%28ISSN%291936-2714>
- Richgels, D. J. (2001). Phonemic awareness. *The Reading Teacher*, 55, 274-278. Retrieved from  
<http://onlinelibrary.wiley.com/journal/10.1002/%28ISSN%291936-2714>
- Roswell, F., Chall, J., Curtis, M. E., & Kearns, G. (2005). *Diagnostic assessments of reading, second edition*. Itasca, IL: Riverside Publishing Company.

- Salvia, J., Ysseldyke, J. E., & Bolt, S. (2010). *Assessment in Special and Inclusive Education* (11<sup>th</sup> ed.). Belmont, CA: Wadsworth.
- Scarborough, H. S., & Brady, S. A. (2002). Toward a common terminology for talking about speech and reading: A glossary of the “phon” words and some related terms. *Journal of Literacy Research, 34*(3), 299-336. doi: 10.1207/s15548430jlr3403\_3
- Seidenberg, M. S., & McClelland, J. L. (1989). A distributed, developmental model of word recognition and naming. *Psychological Review, 96* (4), 523-568. doi: 10.1037/0033-295X.96.4.523
- Shaywitz, B. A., Lyon, G. R., & Shaywitz, S. E. (2006). The role of functional magnetic resonance imaging in understanding reading and dyslexia. *Developmental Neuropsychology, 30*, 613-632. doi: 10.1093/brain/123.12.2373
- Shapiro, E. S. (2004). *Academic skills problems: Direct assessment and intervention*. New York, NY: The Guilford Press
- Shinn, M. R., Rosenfield, S., & Knutson, N. (1989). Curriculum-based assessment: A comparison of models. *School Psychology Review, 18*, 299-316. Retrieved from <http://www.nasponline.org/publications/spr/index.aspx?vol=42&issue=2>
- Siegel, L. S. (2006). Perspectives on dyslexia. *Pediatric Child Health, 11*, 581-587. Retrieved from <http://www.ncbi.nlm.nih.gov/pmc/journals/530/>
- Skjelfjord, V. (1976). Teaching children to segment spoken words as an aid in learning to read. *Journal of Learning Disabilities, 9*, 297-306. doi: 10.1177/002221947600900507
- Snowling, M. J. (1981). Phonemic deficits in developmental dyslexia. *Psychological Research, 43*(2), 219-234. doi: 10.1007/BF00309831

- Soltani, A., & Roslan, S. (2013). Contributions of phonological awareness, phonological short-term memory, and rapid automated naming, toward decoding ability in students with mild intellectual disability. *Research in Developmental Disabilities, 34*, 1090-1099. doi: 10.1016/j.ridd.2012.12.005
- Speece, D. L., Mills, C, Ritchey, K. D., & Hillman, E. (2003). Initial evidence that letter fluency tasks are valid indicators of early reading skill. *Journal of Special Education, 36*, 223-233. doi: 10.1177/002246690303600403
- Spencer Learning (2010). *Ultimate phonics scope and sequence*. Walnut, CA: Spencer Learning
- Stahl, S. A., & Murray, B. A. (1994). Defining phonological awareness and its relationship to early reading. *Journal of Educational Psychology, 86*, 221-234. Retrieved from <http://psycnet.apa.org/journals/edu/>
- Stanovich, K. E. (1992). Speculations on the causes and consequences of individual differences in early reading acquisition. In R. B. Gough, L. C. Ehri, & R. Treiman (Eds.), *Reading acquisition* (pp. 307 – 342). Hillsdale, NJ: Erlbaum.
- The Psychological Corporation. (2003). *Early Reading Diagnostic Assessment* (2<sup>nd</sup> ed.). San Antonio, TX: Pearson Assessment.
- Torgesen, J. K. (2002). The prevention of reading difficulties. *Journal of School Psychology, 40*, 7-26. doi: 10.1016/S0022-4405(01)00092-9
- Torgesen, J. K., Wagner, R. K., & Rashotte, C. A. (1999). *Test of Word Reading Efficiency*. Austin, TX: PRO-ED
- Vandervelden, M.C., & Siegel, L.S. (1995). Phonological recoding and phoneme awareness in early literacy: A developmental approach. *Reading Research Quarterly, 30*(4), 845-875. Retrieved from <http://www.reading.org/General/Publications/Journals/RRQ.aspx>

- Vanderwood, M. L., Linklater, D., Healy, K. (2008). Predictive accuracy of nonsense word fluency for english language learners. *School Psychology Review, 37*, 5-17. Retrieved from <http://www.nasponline.org/publications/spr/index-list.aspx>
- Vandewalle, Boets, Ghesquiere, & Zink (2012). Development of phonological processing skills in children with specific language impairment with and without literacy delay: A 3-year longitudinal study. *Journal of Speech, Language, and Hearing Research, 55*, 1053-1067. doi: 10.1044/1092-4288(2011/10-0308)
- Wagner, R. K., & Torgesen, J. K. (1987). The nature of phonological processing and its causal role in the acquisition of reading skills. *Psychological Bulletin, 101*, 192-212. doi: 10.1037/0033-2909.101.2.192
- Wagner, R. K., Torgesen, J. K., Laughon, P., Simmons, K., & Rashotte, C. A. (1993). Development of young readers' phonological processing abilities. *Journal of Educational Psychology, 85*, 83-103. Retrieved from <http://psycnet.apa.org/journals/edu/>
- Wagner, R. K., Torgesen, J. K., Rashotte, C. A., Hecht, S. A., Barker, T. A., Burgess, S. R., Donahue, J., & Garon, T. (1997). Changing relations between phonological processing abilities and word-level reading as children develop from beginning to skilled readers: A 5-year longitudinal study. *Developmental Psychology, 33*, 468-479. doi: 10.1037/0012-1649.33.3.468
- Weschler, D. (2003). *Weschler Intelligence Scale for Children, fourth edition*. San Antonio, TX: Pearson Assessment.
- Weschler, D. (2010). *Weschler Individual Achievement Test (3<sup>rd</sup> ed)*. San Antonio, TX: Pearson Assessment.

- Woodcock, R. W. (2011). *Woodcock Reading Mastery Tests* (4<sup>th</sup> ed.). San Antonio, TX: Pearson Assessment.
- Woodcock, R. W., McGrew, K. S., & Mather, N. (2001). *Woodcock-Johnson III*. Itasca, IL: Riverside.
- Yovanoff, P., Duesbery, L., Alonzo, J., & Tindal, G. (2005). Grade-level invariance of a theoretical causal structure predicting reading comprehension with vocabulary and oral reading fluency. *Educational Measurement: Issues and Practice*, 24, 4-12. Retrieved from <http://onlinelibrary.wiley.com/journal/10.1111/%28ISSN%291745-3992>
- Ziegler, J. C., Perry, C., Jacobs, A. M., & Braun, M. (2001). Identical words are read differently in different languages. *Psychological Science*, 12, 379- 384. doi: 10.1111/1467-9280.00370
- 95% Group Inc. (2013). *Phonics Screener for Intervention* (3<sup>rd</sup> ed.). Lincolnshire, IL: 95% Group In.

## Tables

Table 1

*Phonological Sensitivity Skills in Developmental Sequence*

Skill	Example
<b>Phonological Awareness</b>	
Rhyme detection	“Does <i>tap</i> rhyme with <i>sad</i> ?”
Rhyme creation	“Change the first sound in <i>tap</i> to make a word that rhymes with <i>tap</i> ”
Rhyme production	“What word rhymes with <i>tap</i> ?”
Rhyme recognition	“Does <i>map</i> rhyme with <i>tap</i> ?”
Rhyme oddity	“Which word does not rhyme with the others: <i>tap-map-sad</i> ?”
Syllable blending	“What word is this? Listen, /lob/ /ster/”
Sentence segmentation	“Tell me how many words you hear in this sentence. Listen. <i>The girl wore a pink dress</i> ”
Syllable segmentation	“Count the syllables in this word. Listen. <i>Bakery</i> .”
Syllable deletion-compound word	“Listen. <i>Bedtime</i> . Say <i>bedtime</i> . Take away <i>bed</i> . What word is left?”
Syllable deletion- multisyllabic word	“Listen. <i>Carpenter</i> . Say it again without <i>car</i> .”
<b>Phonemic Awareness</b>	
Phoneme blending	“What word is this? /t/ /a/ /p/”
Sound-to-word matching	
Initial phoneme recognition	“Does <i>tap</i> start with /t/?”
Final phoneme recognition	“Does <i>tap</i> end with /p/?”
Phoneme location	“Listen for /t/. <i>Tap</i> . Is /t/ the beginning or ending sound?”
Phoneme recognition and location	“Listen. /t/, <i>neck</i> . First, last, or no?”
Word-to-word matching	
Initial consonant same	“Does <i>tap</i> start with the same sound as <i>toy</i> ?”
Initial consonant different	“Listen. <i>Tap</i> . Which word has a different beginning sound from <i>tap</i> ? <i>Hop- Toy- Tab.</i> ”
Phoneme isolation	
Initial phoneme isolation	“What is the beginning sound in <i>tap</i> ?”
Final phoneme isolation	“What is the ending sound in <i>tap</i> ?”
Medial phoneme isolation	“What is the middle sound in <i>tap</i> ?”
Phoneme counting	“How many sounds do you hear in the word <i>tap</i> ?”
Phoneme segmentation	“Say <i>tap</i> one sound at a time”
Phoneme deletion	
Final phoneme deletion	“Listen. Say <i>feet</i> . Now say it without the /t/.”
Initial phoneme deletion	“Listen. Say <i>meat</i> . Now say it without the /m/.”
Delete first consonant of a blend	“Listen. Say <i>tray</i> . Now take away /t/. What word is left?”
Medial phoneme deletion	“Listen. <i>Sleep</i> . Say <i>sleep</i> . Take away /l/. What word is left?”
Phoneme substitution	“Say <i>tap</i> . Now say it again, but instead of /t/ say /m/.”
Phoneme reversal	“Listen. <i>Tap</i> . Say <i>tap</i> . Now change the /t/ and /p/ around.”

*Note.* This table was adapted from Pufpaff (2009) and examples of each skill were modified.

Table 2

*Interobserver Agreement Data for Research Assistant Training*

Measure	Mean % Agreement	Min %	Max %	N
P-CBM-TLU	88.80	81.82	97.62	28
P-CBM-WWR	82.91	70.27	97.22	28
NWF-CLS	96.60	94.08	98.64	28
NWF-WWR	92.05	88.46	95.92	28
95% Group PSI	95.66	91.53	98.40	28

*Note.* Phonics Curriculum-Based Measurement (P-CBM); Targeted Linguistic Unit (TLU); Whole Words Read (WWR); Nonsense Word Fluency (NWF); Correct Letter Sequences (CLS); 95% Group Phonics Screener for Intervention (PSI)

Table 3  
*Interobserver Agreement Data for P-CBM*

Measure	Mean % Agreement	Min %	Max %	N
Form A-TLU	91.80	55.00	100	38
Form A-WWR	77.33	0	100	38
Form B- TLU	90.22	62.5	100	38
Form B- WWR	78.07	0	100	38
Form C- TLU	90.09	50	100	38
Form C- WWR	83.87	20	100	38

*Note.* Phonics Curriculum-Based Measurement (P-CBM); Targeted Linguistic Unit (TLU); Whole Words Read (WWR)

Table 4

*Descriptive Statistics for P-CBM, NWF, and PSI*

Measure	M	SD	N
P-CBM Form A TLU	18.33	13.82	216
P-CBM Form B TLU	16.81	12.85	216
P-CBM Form C TLU	17.60	13.09	216
P-CBM Form A WWR	12.75	12.69	216
P-CBM Form B WWR	12.08	11.41	216
P-CBM Form C WWR	12.31	11.55	216
NWF CLS	65.69	37.86	213
NWF WWR	18.29	14.53	209
PSI	109.66	16.84	184

*Note.* Phonics Curriculum-Based Measurement (P-CBM); Targeted Linguistic Unit (TLU); Whole Words Read (WWR); Nonsense Word Fluency (NWF); Correct Letter Sequences (CLS); 95% Group Phonics Screener for Intervention (PSI)

Table 5

*Summary of Correlations between P-CBM, NWF, and PSI*

Measure	1	2	3	4	5	6	7	8	9
1. P-CBM <sup>a</sup> Form A TLU <sup>b</sup>	-								
2. P-CBM Form B TLU	.939	-							
3. P-CBM Form C TLU	.942	.944	-						
4. P-CBM Form A WWR <sup>c</sup>	.966	.902	.918	-					
5. P-CBM Form B WWR	.919	.954	.913	.938	-				
6. P-CBM Form C WWR	.914	.903	.960	.943	.941	-			
7. NWF <sup>d</sup> CLS <sup>e</sup>	.822	.849	.868	.804	.827	.845	-		
8. NWF WWR	.792	.797	.824	.817	.828	.852	.890	-	
9. PSI <sup>f</sup>	.607	.591	.606	.544	.546	.536	.504	.467	-

*Note.* All correlation coefficients are statistically significant at  $p < .001$ .

<sup>a</sup> Phonics Curriculum-Based Measurement (P-CBM); <sup>b</sup> Targeted Linguistic Unit (TLU); <sup>c</sup> Whole Words Read (WWR); <sup>d</sup> Nonsense Word Fluency (NWF); <sup>e</sup> Correct Letter Sequences (CLS); <sup>f</sup> 95% Group Phonics Screener for Intervention (PSI)

## Appendix A: Cover Letter for Research Request

11/20/13

Dear School Administrator:

Thank you for reviewing my application and request to conduct research at the [school name] school district. I am a doctoral-level school psychology graduate student at Alfred University and currently am conducting my dissertation for partial fulfillment of the requirements for the degree of Doctor of Psychology in School Psychology. I am interested in partnering with your school to collect data for this project. This project will require few time and resources from the school staff and potentially could add resources to the school for collection of AIMSweb winter 2014 benchmark data.

With your permission, I am interested in coming to your school district to collect data from **first grade students** in order to determine the reliability and validity of a new mixed skill phonics curriculum-based measurement tool called "Phonics Curriculum-Based Measurement" (P-CBM). Data collection would occur during the **winter 2014 AIMSweb benchmark period (January 2014)**. To determine the reliability and validity of this new screening and progress monitoring tool, an additional measure called the 95% Group Phonics Screener for Intervention (PSI) will also be administered to all first grade students. It is anticipated that the total amount of time per student to administer these two measures is **10 minutes**. Additionally, AIMSweb benchmark Nonsense Word Fluency (NWF) and Oral Reading Fluency (R-CBM) data will be gathered from the AIMSweb data management system for additional criterion measures.

My hope is to find initial evidence of reliability and validity for this new reading tool. In the future, I would like to continue studying the efficacy of using this tool for screening and progress monitoring purposes. My goal is to provide teachers and interventionists with an additional helpful tool that they can use to make more efficient instructional decisions regarding phonics skills.

If you are willing (or unwilling) to have your school participate in this project you may reply to my email address or by phone. Please do not hesitate to call or email me to answer any questions that you may have. Please review the attached application form and example informed consent form for student participation.

Thank you in advance for your consideration,



Chad Swanson, M.A.  
Doctoral Graduate Student  
Division of Counseling and School Psychology  
Alfred University  
CS14@alfred.edu  
(716) 397- 0804

## Appendix B: Request for Research Form

**REQUEST TO CONDUCT RESEARCH  
IN THE [name of school] SCHOOL DISTRICT**

**APPLICATION**

**NAME:** Chad C. Swanson

**University:** Alfred University: Psy.D. School Psychology Program

**Reason for Research:** Dissertation study to fulfill the requirements for the degree of Doctor of Psychology in School Psychology

**Title of Project:** Phonics Curriculum-Based Measurement: An Initial Study of Reliability and Validity

**1. Basic concept and goal of the proposed research.**

- This is a test construction project which seeks to establish a mixed skill phonics curriculum-based measurement (CBM) tool called Phonics Curriculum-Based Measurement (P-CBM). P-CBM would ideally be used as a screening and progress monitoring tool to identify students who may struggle on a variety of basic phonic tools as well as to monitor progress and response to intervention.

**2. Contribution of the project to the field of education.**

- There are no current mixed skill phonics progress monitoring tools available in the field to both screen and progress monitor basic phonics skills other than letter sound fluency measures or basic CVC words. Skills which will be included on this measure are CVC, consonant blend, consonant digraph, and long vowel silent-e words. The ability to efficiently measure these skills will allow teachers to determine whether or not these skills are mastered. If these skills are sufficiently mastered, teachers and interventionists will be able to make faster instructional decisions to move on to the next more challenging phonics skills. This will decrease the amount of time that instruction was targeted at skills that are already established and will increase time targeting appropriate phonics skills.

**3. List of the names of all measurement instruments that will be utilized**

- Phonics Curriculum-Based Measurement (P-CBM)
  - Researcher made CBM probes
  - 1 minute long probes which are similar to existing CBM tools
  - Consist of an equal amount of CVC, consonant blend, consonant diagraph, and silent-e pseudowords

- For the purposes of this project, 3 P-CBM probes will be administered in order to collect data on alternate forms reliability
- 95% Group- Phonics Screener for Intervention (PSI)
  - Commercially developed diagnostic screening tool for phonics
  - Used to determine instructional planning in the area of phonics
  - Will take 5-7 minutes to administer
  - Only administer once to each student
- Collection of the School's AIMSweb Benchmark Data
  - The current researcher is requesting access to the following RtI AIMSweb benchmark data:
    - Nonsense word fluency (NWF): January 2014 Winter Benchmark Data
    - Oral reading fluency (R-CBM): Spring 2014, Fall 2014, Winter 2014, Spring 2015 benchmark data

#### **4. Characteristics of Participants**

- 60-80 first grade elementary school students (Entire first grade level)

#### **5. Time Required Per Participant**

- 10 minutes

#### **6. Potential benefits to the School**

- Data collection will occur concurrently with the winter AIMSweb screening benchmark
- The current researcher as well as a team of data collectors will be available to assist in the collection of first grade benchmark probes in addition to administering the P-CBM and PSI tools.

#### **7. Date requested to Begin**

- January 2014

#### **8. Date Anticipated for Completion**

- February 2014 (Data collection)
- May 2015 (Collection of AIMSweb benchmark data)

#### **9. Date of Doctoral Dissertation Proposal**

- November 17, 2013

#### **10. Date Anticipated for Institutional Review Board (IRB) Approval**

- December, 2013



Division of Counseling  
& School Psychology  
One Saxon Drive  
Alfred, NY 14802  
607.871.2212  
Fax: 607.871.3422

## Appendix C: Passive Informed Consent Form for Partnering School 1

12/9/13

Dear Parental Guardian,

I am a doctoral level graduate student in the division of counseling and school psychology at Alfred University. I am currently completing my dissertation for partial fulfillment of the requirements for the degree of Doctor of Psychology in School Psychology. I am partnering with your child's school district, [name of school] School District, in order to collect data towards the completion of my dissertation. The topic of my research study is to create a mixed skill phonics reading measure that can be useful to provide screening and progress monitoring data to teacher to assist in student reading development.

With your permission, I am interested in having your child participate in my dissertation study. If you agree to allow your child participate in this research opportunity, your child would be pulled out of class for **approximately 10 minutes** in order to be administered the new measure I developed called Phonics Curriculum-Based Measurement (P-CBM) as well as a phonics screening tool called the 95% Group Phonics Screener for Intervention (PSI). Additionally, your child's reading benchmark data (Nonsense Word Fluency and Oral Reading Fluency) will be gathered and used as additional criterion data measures.

My hope is to find initial evidence of reliability and validity for this new reading tool. In the future, I would like to continue studying the usefulness of this tool for screening and progress monitoring purposes. My goal is to provide teachers and interventionists with an additional helpful phonics assessment that they can use to make more efficient instructional decisions regarding phonics skills.

If you are willing to have your child participate in this project you do not have to do anything. Simply keeping this letter and attached consent form for your records will allow your child to be a participant in this doctoral dissertation study.

If you do not wish to have your child participate in this study, please detach the refusal of informed consent from the consent form, sign it, and mail it to the address provided by [date]. By signing and sending in the attached refusal of consent form, your child will be excluded from this study.

Thank you in advance for your consideration,

A handwritten signature in black ink that reads "Chad Swanson".

Chad Swanson, M.A.  
Doctoral Candidate of School Psychology  
Division of Counseling and School Psychology  
Alfred University

## Division of Counseling and School Psychology

### Participant Consent Form

**Purpose:**

The purpose of this research project is to study the initial reliability and validity of a mixed skill phonics curriculum-based phonics progress monitoring tool. This research project is a doctoral dissertation study, under the supervision of Dr. Mark Fugate who is the committee chairperson for Chad Swanson's dissertation committee.

**Procedure:**

If you agree to allow your child to participate in this study, your child will be administered the Phonics Curriculum-Based Measurement (P-CBM) and 95% Group Phonics Screener for Intervention (PSI) tools. The approximate amount of time to administer these measures to your child is **10 minutes**. Additionally, AIMSweb benchmark (Nonsense Word Fluency and Oral Reading Fluency) data will be gathered from school records in order to collect criterion measures.

**Benefits/Risks to Participant:**

There are minimal anticipated risks for participation in this study. Benefits include gaining experience as a research participant and being able to work one-on-one with a data collector.

**Voluntary Nature of the Study/Confidentiality:**

Your child's participation in this study is entirely voluntary and you may refuse for your child to be a participant in this study at any point in time. In order to refuse participation in the current study, please sign and send this form to the address provided below. You may also contact the researcher to answer or address any questions or concerns you have regarding this study by emailing the researcher at the address provided below.

Information that would make it possible to identify your child or any other participant will never be included in any sort of report. The data will be accessible only to the researcher working on the project and to the doctoral dissertation committee members. In the data management system, your child will be assigned a number thereby making it impossible to link your child's name to any of the results of the reading measures to ensure confidentiality. Raw data containing your child's name will be kept in a locked filing cabinet and will only be accessible to the researcher and doctoral committee members.

**Contacts and Questions:**

At this time you may ask any questions you may have regarding this study. If you have questions later, you may contact: Chad Swanson at cs14@alfred.edu. The faculty supervisor of this study may be contacted with questions as well: Dr. Mark Fugate at ffugate@alfred.edu. Questions or concerns about institutional approval should be directed to Dr. Danielle Gagne, Chair of the Institutional Review Board for Human Subjects, (607) 871-2213. Waivers of informed consent can be sent to:

Alfred University  
Division of Counseling and School Psychology  
1 Saxon Dr.  
Alfred, NY 14802  
Attn: Chad Swanson

-----  
(Please Cut and Detach)

**Refusal of Consent to Participate:**

I have read the above information and I **do not** give permission for my child to participate in this doctoral dissertation research study. I understand that I must send this waiver of informed consent sheet to the researcher by 1/3/14 to the address provided. I understand that I may contact the researcher, faculty supervisor, or chair of the Institutional Review Board for any questions or concerns. I also understand that I may change my mind at any time and allow my child to participate by emailing Chad Swanson at the email address provided.

Name of Student Participant \_\_\_\_\_  
(please print)

Name of Parental Guardian \_\_\_\_\_  
(please print)

Date: \_\_\_\_\_

Signature of Parental Guardian \_\_\_\_\_



Division of Counseling  
& School Psychology  
One Saxon Drive  
Alfred, NY 14802  
607.871.2212  
Fax: 607.871.3422

## Appendix D: Passive Informed Consent Form for Partnering School 2

12/23/13

Dear Parental Guardian,

I am a doctoral level graduate student in the division of counseling and school psychology at Alfred University. I am currently completing my dissertation for partial fulfillment of the requirements for the degree of Doctor of Psychology in School Psychology. I am partnering with your child's school district, [name of school] School District, in order to collect data towards the completion of my dissertation. The topic of my research study is to create a mixed skill phonics reading measure that can be useful to provide screening and progress monitoring data to teacher to assist in student reading development.

With your permission, I am interested in having your child participate in my dissertation study. If you agree to allow your child participate in this research opportunity, your child would be pulled out of class for **approximately 10 minutes** in order to be administered the new measure I developed called Phonics Curriculum-Based Measurement (P-CBM) as well as a phonics screening tool called the 95% Group Phonics Screener for Intervention (PSI). Additionally, your child's reading benchmark data (Nonsense Word Fluency [NWF] and Oral Reading Fluency) will be gathered and used as additional criterion data measures.

Your child's school will have access to his/her performance on the 95% Group PSI measure so that the school may use this additional information when making instructional grouping decisions as part of the schools preexisting Response to Intervention system. The school already will be making decisions on whether your child needs additional reading interventions as well as the particular reading group to place your child in using other universal screening measures (e.g., NWF; Oral Reading Fluency). The PSI data will simply give the district additional helpful information regarding your child's phonics skill development when making these decisions. If you do not feel comfortable sharing this information with the school, simply send in the Refusal of Informed Consent form attached to this letter. P-CBM data will not be shared with the school, as this measure is not yet determined to be a reliable or valid measure of phonics skills.

My hope is to find initial evidence of reliability and validity for this new reading tool. In the future, I would like to continue studying the usefulness of this tool for screening and progress monitoring purposes. My goal is to provide teachers and interventionists with an additional helpful phonics assessment that they can use to make more efficient instructional decisions regarding phonics skills.

If you are willing to have your child participate in this project you do not have to do anything. Simply keeping this letter and attached consent form for your records will allow your child to be a participant in this doctoral dissertation study.

If you do not wish to have your child participate in this study, please detach the refusal of informed consent from the consent form, sign it, and mail it to the address provided by [date]. By signing and sending in the attached refusal of consent form, your child will be excluded from this study.

Thank you in advance for your consideration,

Chad Swanson, M.A.  
Doctoral Candidate of School Psychology  
Division of Counseling and School Psychology  
Alfred University

## Division of Counseling and School Psychology

### Participant Consent Form

**Purpose:**

The purpose of this research project is to study the initial reliability and validity of a mixed skill phonics curriculum-based phonics progress monitoring tool. This research project is a doctoral dissertation study, under the supervision of Dr. Mark Fugate who is the committee chairperson for Chad Swanson's dissertation committee.

**Procedure:**

If you agree to allow your child to participate in this study, your child will be administered the Phonics Curriculum-Based Measurement (P-CBM) and 95% Group Phonics Screener for Intervention (PSI) tools. The approximate amount of time to administer these measures to your child is **10 minutes**. Additionally, AIMSweb benchmark (Nonsense Word Fluency and Oral Reading Fluency) data will be gathered from school records in order to collect criterion measures.

**Benefits/Risks to Participant:**

There are minimal anticipated risks for participation in this study. Benefits include gaining experience as a research participant and being able to work one-on-one with a data collector. Additionally, the school may better understand your child's phonics skill development as a result of the school receiving data from the 95% Phonics Screener for Intervention (PSI).

**Voluntary Nature of the Study/Confidentiality:**

Your child's participation in this study is entirely voluntary and you may refuse for your child to be a participant in this study at any point in time. In order to refuse participation in the current study, please sign and send this form to the address provided below. You may also contact the researcher to answer or address any questions or concerns you have regarding this study by emailing the researcher at the address provided below.

Information that would make it possible to identify your child or any other participant will never be included in any sort of report. The P-CBM data will be accessible only to the researcher working on the project and to the doctoral dissertation committee members. In the data management system, your child will be assigned a number thereby making it impossible to link your child's name to any of the results of the reading measures to ensure confidentiality. Raw P-CBM data containing your child's name will be kept in a locked filing cabinet and will only be accessible to the researcher and doctoral committee members. The school will have access to your child's PSI results and may use this data when determining the need for additional intervention in reading as well as what group to include your child in.

**Contacts and Questions:**

At this time you may ask any questions you may have regarding this study. If you have questions later, you may contact: Chad Swanson at cs14@alfred.edu. The faculty supervisor of this study may be contacted with questions as well: Dr. Mark Fugate at ffugate@alfred.edu. Questions or concerns about institutional approval should be directed to Dr. Danielle Gagne, Chair of the Institutional Review Board for Human Subjects, (607) 871-2213. Refusal of informed consent can be sent to:

Alfred University  
Division of Counseling and School Psychology  
1 Saxon Dr.  
Alfred, NY 14802  
Attn: Chad Swanson

-----  
(Please Cut and Detach)

**Refusal of Consent to Participate:**

I have read the above information and I **do not** give permission for my child to participate in this doctoral dissertation research study. I understand that I must send this waiver of informed consent sheet to the researcher by 1/17/14 to the address provided. I understand that I may contact the researcher, faculty supervisor, or chair of the Institutional Review Board for any questions or concerns. I also understand that I may change my mind at any time and allow my child to participate by emailing Chad Swanson at the email address provided.

Name of Student Participant \_\_\_\_\_  
(please print)

Name of Parental Guardian \_\_\_\_\_ Date: \_\_\_\_\_  
(please print)

Signature of Parental Guardian \_\_\_\_\_

## Appendix E: Teacher Outreach Letter for Partnering School District 1

December 5, 2013

Dear Teachers,

I am a doctoral level graduate student in the division of counseling and school psychology at Alfred University. I am currently completing my dissertation for partial fulfillment of the requirements for the degree of Doctor of Psychology in School Psychology. With the approval of administration, I am partnering with your school district in order to collect data towards the completion of my dissertation. The topic of my research study is to create a mixed skill phonics reading measure, called Phonics Curriculum-Based Measurement (P-CBM), which can be useful to provide screening and progress monitoring data to teacher to assist in student reading development.

Data collection will occur during the winter AIMSweb benchmark period. I will be collecting data from the entire **First Grade**. My data collection team, consisting of graduate students in school psychology at Alfred University, will assist the school in collecting **First Grade** AIMSweb reading data (e.g., Nonsense Word Fluency). This will provide your school with additional resources during the winter benchmark. In addition to collecting the AIMSweb data, my data collection team will administer the 95% Group Phonics Screener for Intervention (PSI) to the entire **First Grade**. Lastly, my team of data collectors will administer the P-CBM tool.

My hope is to find initial evidence of reliability and validity for this new reading tool. In the future, I would like to continue studying the usefulness of this tool for screening and progress monitoring purposes. My goal is to provide teachers and interventionists with an additional helpful phonics assessment that they can use to make more efficient instructional decisions regarding phonics skills.

Sincerely,



Chad Swanson, M.A.  
Doctoral Candidate of School Psychology  
Division of Counseling and School Psychology  
Alfred University

## Appendix F: Teacher Outreach Letter for Partnering School District 2

December 23, 2013

Dear Teachers,

I am a doctoral level graduate student in the division of counseling and school psychology at Alfred University. I am currently completing my dissertation for partial fulfillment of the requirements for the degree of Doctor of Psychology in School Psychology. With the approval of administration, I am partnering with your school district in order to collect data towards the completion of my dissertation. The topic of my research study is to create a mixed skill phonics reading measure, called Phonics Curriculum-Based Measurement (P-CBM), which can be useful to provide screening and progress monitoring data to teacher to assist in student reading development.

Data collection for this study will occur during the winter AIMSweb benchmark period. I will be collecting data from the entire **First Grade**. My data collection team, consisting of graduate students in school psychology at Alfred University, will assist the school in collecting **First Grade** AIMSweb reading data (e.g., Nonsense Word Fluency). This will provide your school with additional resources during the winter benchmark. In addition to collecting the AIMSweb data, my data collection team will administer the 95% Group Phonics Screener for Intervention (PSI) to the entire **First Grade**. Teachers and interventionists will receive data from the PSI to facilitate reading intervention groupings. Lastly, my team of data collectors will administer the P-CBM tool.

First grade teachers: A direct consultant teacher assisting in this process will contact you in the near future to inform you of who will be pulling students out of your room to collect this data. This teacher will receive times the graduate students are available for data collection and will coordinate data collection schedules.

My hope is to find initial evidence of reliability and validity for this new reading tool. In the future, I would like to continue studying the usefulness of this tool for screening and progress monitoring purposes. My goal is to provide teachers and interventionists with an additional helpful phonics assessment that they can use to make more efficient instructional decisions regarding phonics skills.

Sincerely,



Chad Swanson, M.A.  
Doctoral Candidate of School Psychology  
Division of Counseling and School Psychology  
Alfred University

## Appendix G: Videotape Consent Form for Sample Child

## AUDIO/VIDEOTAPE CONSENT FORM

Phonics Curriculum-Based Measurement: An Initial Study of Reliability and Validity

Primary Investigator: Chad C. Swanson

Alfred University

The purpose of this testing session is to provide a video model for training purposes and is not intended to evaluate your child's reading skills. I understand that the primary investigator will not provide my child or me with any feedback regarding my child's performance on the assessment measures. This session is only intended to provide a video example of how to administer and score phonics skill measures to future examinees. I understand that this video will be utilized during data collection training for the primary investigator's dissertation study. I understand that this video may be included in future training sessions within professional or educational contexts (e.g., professional development trainings; teacher in-service trainings; graduate academic coursework). I understand that my child's name and personal information will be kept confidential and will never be disclosed to any future trainee who may view this video. I understand that this video will be stored on a password protected electronic device (i.e., computer) as well as on a DVD that will be stored in a locked filing cabinet. I understand that I may withdraw my child's consent at any time to participate in this videotaped testing session. I also understand that I may refuse at any time for my child's video to be included in the primary investigator's data collection training and/or future training sessions.

I have read the above information, was provided with additional information if necessary, and consent for my child, \_\_\_\_\_, to participate in this testing session and be audio/video taped for the abovementioned purposes.

\_\_\_\_\_  
Parental Guardian (Please print)

\_\_\_\_\_  
Child Participant

\_\_\_\_\_  
Parental Guardian (Please sign)

\_\_\_\_\_  
Date

I have been told that I have the right to watch the recording of the testing session before it is used. I have decided that I:

\_\_\_\_ want to listen to the recording

\_\_\_\_ do not want to listen to the recording

\_\_\_\_\_  
Parental Guardian (Please sign)

\_\_\_\_\_  
Date

Appendix H: ABCD Interobserver Agreement Data Chart

Raters: \_\_\_\_\_

Percent Agreement: \_\_\_\_\_%

Student: \_\_\_\_\_

Form: A B C / TLU WWR /

NWF-CLS / NWF-WWR / PSI

<b>A</b>	<b>B</b>
<b>C</b>	<b>D</b>

**Fig. 1.** Two by two matrix notation of interobserver agreement for a behavior category.

- A** = number of agreements on occurrence.
- B** = number of disagreements where observer 1 coded the category and observer 2 did not.
- C** = number of disagreements where observer 1 did not code the category and observer 2 did.
- D** = number of agreements on nonoccurrence.

$$\frac{A}{A+B+C} \times 100$$

## Appendix I: Biographical Sketch

**Education**

<b>Psy.D., School Psychology</b>	Alfred University, Alfred, NY NASP- approved/APA- accredited August 2014
<b>MA, School Psychology</b>	Alfred University, Alfred, NY NASP-approved/ APA-accredited MA, May 2011; CAS, May 2014
<b>BA, Psychology</b>	SUNY Fredonia, Fredonia, NY Minor: Sociology May 2009
<b>AA, Liberal Arts and Sciences</b>	Jamestown Community College, Jamestown, NY Concentration in Psychology May 2007

**Professional Associations: Memberships**

American Psychological Association (APA)  
National Association of School Psychologists (NASP)  
New York Association of School Psychologists (NYASP)

**Selected Awards & Honors***Alfred University*

2014	Lea R. Powel Honor's Award Recipient for Outstanding Performance by a Doctoral Student
2014	Lea R. Powell Research Grant Recipient
2013	<i>Phi Kappa Phi</i> Love of Learning Scholarship Recipient
2013	<i>Phi Kappa Phi</i> National Honor Society
2010-2014	Federal Doctoral Leadership Grant Recipient
2009-2010	Rural Justice Institute (RJI) Mentoring Grant Recipient

*SUNY Fredonia*

2009	Daniel C. Krawczyk Exemplary Award
2009	<i>Psi Chi</i> Virginia Sexton Memorial Award
2009	<i>Psi Chi</i> National Honor Society
2008	Psychology Department Merit Award Honorable Mention

**Specialized Training in School Psychology**

2010-2014	<b>Powell Academic Leadership Fellow</b> , Alfred University <ul style="list-style-type: none"> <li>▪ Completed a federal leadership grant program designed to prepare leaders in the education and training of future school psychology practitioners</li> <li>▪ Completed specialized coursework in pedagogy and research design</li> <li>▪ Participated in supervised teaching experiences and joint faculty-student research</li> </ul>
-----------	---

**Practicum and Internship Experience**

- 2013-2014    **Pre-Doctoral Psychology Intern**, Upstate Cerebral Palsy  
On-Site Supervisor: Jean Jacobson, Ph.D.  
  - 2000 hour full-time APPIC member clinical and school psychology internship
- 2012-2013    **School Psychology Intern**, Allegany-Limestone Central School District  
On-Site Supervisor: John Wolfgang, Psy.D.  
  - 600 hour part-time school psychology internship
- 2012-2013    **Graduate Student Clinician**, ACCORD Corporation  
Clinical Supervisor: Ellen Faherty, Psy.D.
- 2010-2011    **Graduate Student Clinician**, Child and Family Services Center of Alfred University  
Clinical Supervisor: Jana Atlas, Ph.D.
- 2009-2011    **Graduate Practicum Student**, Avoca Central School  
On-Site Supervisor: Kelly Buisch, MA/CAS

**Teaching Experience**

- 2012-2013    **Adjunct Instructor**, Alfred University  
PSYC 101- Introduction to Psychology  
PSYC 472- Child Interventions  
PSYC 626- Psychological and Educational Measurements
- 2011-2012    **Teaching Assistant**, Alfred University  
PYSC 627- Norm-Referenced Testing I  
PSYC 623- Norm-Referenced Testing II
- 2008-2009    **College Tutoring Services (CTS) Psychology Tutor**, SUNY Fredonia

**Research Experience**

- 2012- 2014    **Dissertation Student**, Alfred University  
Dissertation Chair: Mark Fugate, Ph.D.
- 2011-2014    **Research Team Member**, Alfred University  
Faculty Mentor: Hannah Young, Psy.D.
- 2010            **Research Team Member**, Alfred University  
Faculty Mentor: Cris Lauback, Psy.D.
- 2010            **Research Assistant**, Alfred University  
Dissertation Candidates: Nancy Issa and Lanora Duell

## Publications

Gee, N. R., Gould, J. K., Swanson, C. C., & Wagner, A. K. (2012). Preschoolers categorize animate objects better in the presence of a dog. *Anthrozoos*, 25, 187-198.

## Selected Conference Presentations

Bowen, A. L., Gomez, J. A., & Swanson, C. C. (2011, February). Teacher and administrator perceptions of zero tolerance vs. PBIS. Poster presented at the National Association of School Psychologists Conference (NASP), San Francisco, CA.

Swanson, C. C., Hussar, J. M., & Young, H. L. (2012, August). Parent perceptions of rural school psychologists. Poster presented at the American Psychological Association Conference (APA), Orlando, FL.

Hussar, J. M., Swanson, C. C., Young, H. L. (2013, February). The peer-interpersal procedure- An intervention to improve vocabulary knowledge. Poster presentation at the National Association of School Psychologists (NASP), Seattle, WA.

Hussar, J. M., Swanson, C. C., Young, H. L. (2013, August). The peer-interpersal procedure- A follow-up investigation. Poster presentation at the American Psychological Association Conference (APA), Honolulu, HI.

## Selected Related Trainings

2014	<b>NYS Dignity for All Students Act (DASA) Training</b> , OHM BOCES
2013	<b>Trauma Focused Cognitive Behavioral Therapy</b> , Upstate Cerebral Palsy
2011	<b>Safe Schools against Violence in Education (SAVE) Training</b> , Alfred University
2010	<b>Summer Treatment Program Trainer Training</b> , Erie, PA
2010	<b>Play Therapy Training Workshop</b> , Alfred University
2009	<b>DIBELS Institute Training Workshop</b> , Alfred University
2008, 2009	<b>Summer Treatment Program Counselor Training</b> , Buffalo, NY

## Academic/ Community Service

2011	<b>Graduate Student Representative</b> , Alfred University ITS Printer Use Committee
2009-2012	<b>Class Representative</b> , Alfred University 2012 School Psychology Cohort
2009-2011	<b>Alfred University Graduate Student Senate Club Co-Founder</b> , Alfred University
2007- 2009	<b>Volunteer Compeer Mentor</b> , Chautauqua County, New York
2007	<b>Psychology Club President</b> , Jamestown Community College