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AN EXAMINATION OF THE PROPERTIES, USES AND INTERPRETATIONS OF FIRST GRADE READING SCREENING TOOLS IN ONE SCHOOL DISTRICT

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A Dissertation Presented

by

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ABSTRACT

AN EXAMINATION OF THE PROPERTIES, USES AND INTERPRETATIONS OF FIRST GRADE READING SCREENING TOOLS IN ONE SCHOOL DISTRICT

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Early identification of children who are likely to struggle to achieve reading proficiency is essential to providing them timely access to effective interventions. Thus, universal screening is a critical feature of preventative service delivery models that identify students at risk and provide early support for reading difficulties. As schools choose assessment tools for this purpose, three aspects of universal screening tools are especially important to consider: appropriateness for the intended use, technical adequacy, and usability. Using these standards for assessment review, this study investigated two screening tools commonly used to identify first-graders at risk for reading failure: the Aimsweb Tests of Early Literacy (TEL) and Reading Curriculum Based Measurement- Reading (R-CBM), and the Developmental Reading Assessment-Second Edition (DRA2), an informal reading inventory (IRI). First, test materials were examined for evidence of alignment to important constructs of interest, usability, and technical adequacy. A questionnaire was employed to gather information from twelve first-grade educators from four elementary schools in one diverse suburban district about decisions made using data from each assessment. Finally, to examine predictive validity,

an important aspect of technical adequacy, scores on each screening tool as well as third-grade outcome measures were analyzed for 269 students in the participating district.

Results indicated that the TEL measures were more closely aligned to early reading constructs of interest than the DRA2, and also demonstrated more efficient usability characteristics. However, the educator questionnaire revealed that both assessments are endorsed by teachers for the purpose of screening. While both tools are indeed predictive of later reading achievement, neither resulted in adequate classification accuracy to be recommended for use as a stand-alone screening tool. In addition, the DRA2 resulted in high levels of problematic false negative screening results, meaning that it under identifies students at risk, potentially neglecting students' access to timely intervention. Analysis of classification accuracy for subgroups including English language learners and students eligible for free and reduced lunch revealed that classification accuracy varies by subgroup membership, affecting the predictive validity of screening tools with these populations. Implications for practice and future research are addressed.

This study replicates previous studies related to the predictive validity of first-grade CBM tools, fills a gap in the extant research related to the use of IRIs as screening tools in early grades, and informs educators who wish to evaluate screening tools for appropriateness at the local level.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figure Page

CHAPTER 1

INTRODUCTION, BACKGROUND, AND PURPOSE

Introduction

Literacy is essential to success in modern society, and it is critical to long-term academic achievement that reading skills develop during the first few years of schooling. Early identification of children who are likely to struggle to achieve reading proficiency is important to providing them access to timely, effective interventions and ultimately changing the trajectory of their reading development. Educators have limited instructional resources (i.e., time, teachers and materials) to devote to remediating the needs of large numbers of struggling readers in second and third-grades, by which time lower order literacy skills should be mastered to allow for a level of reading proficiency that allows readers to learn from text. In contrast, preventing delays in the development of proficient reading is more efficient for educators, and wholly beneficial to students. Access to screening measures that can be used to accurately identify which students may need supplemental supports in learning to read and then allocating resources accordingly is critical to effective preventative school practices. There are numerous early reading assessments available to support educators as they make these decisions, yet it is the responsibility of school professionals to consider whether the tools available to them support the inferences they wish to make. This study explores the properties of two types of assessments commonly used by first-grade educators to identify students at risk for reading failure, with particular attention to predictive validity evidence when used as screening tools in one school district.

Trajectories and Consequences of Reading Failure

As students acquire the skills crucial to early reading success, they have more opportunities to engage with successful reading experiences. These accumulated experiences lead to the acquisition of increasingly more advanced literacy skills. However, variations in reading experiences between skillful readers and their less adept peers results in a growing gap between them. Juel (1988) followed the literacy development of a group of students from first-grade through 4th grade and found that, for children who were poor readers at the end of first-grade, there was an 88% chance that they would remain poor readers in fourth grade. Those students who demonstrated at least average reading skills at the end of first-grade were likely to remain average or better readers. She concluded that "the poor first-grade reader almost invariably remains a poor reader by the end of fourth grade" (p. 440). Juel noted that over the course of their first-grade basal reading instruction, the strong readers were exposed to thousands more words than those who were struggling, and that this discrepancy grew exponentially throughout early elementary school. Further, she found that good readers spent more time reading outside of school, further exacerbating the reading opportunities gap.

From Juel's investigation we can project that failure to acquire foundational word reading skills in kindergarten and first-grade is associated with fewer opportunities to engage with text. Other consequences of poor acquisition of early skills include negative attitudes towards reading, fewer opportunities to acquire new vocabulary, and deficits in reading comprehension strategies (Torgesen, 1998). Stanovich (1986) illustrated this phenomenon through his metaphor, "the Matthew Effect", in which he described how the "rich get richer, and the poor get poorer" through a series of reciprocal causal

relationships related to “volume of reading experience”. Without explicit instruction, children who enter school with weak phonological awareness - the ability to focus on and manipulate the sounds in spoken words, and the foundational sound processes in reading acquisition - are unlikely to learn how to apply the alphabetic principle to decode unknown words. These poor readers are exposed to less text than their peers, meaning they have less opportunity to develop automatic recognition of words. Strong readers will rapidly acquire new vocabulary, which is a facilitator of reading comprehension and leads to even more efficient and enjoyable reading.

The gap between strong readers and weak readers persists long after formal education is completed - being a poor reader has lasting consequences for individuals and their communities. Students who are not able to read proficiently by the end of third-grade are more likely to drop out of school and have difficulty finding employment (Snow, Burns & Griffin, 1998; Annie E. Casey Foundation, 2010). These consequences of reading failure become even more urgent when one considers the disparity between reading achievement of high and low-income students, as well as between students from racial and language groups that differ from the majority population. For example, in 2015 46% of White 4th graders scored at or above the proficient range on the National Assessment of Educational Progress (NAEP), while only 18% of Black 4th graders and 21% of Hispanic 4th graders reached proficiency. Fifty two percent (52%) of students not eligible for school lunch programs scored proficient, while only 21% of those that were eligible did the same. Large gaps are also observed between English learners (8% proficient) and their native English-speaking peers (39% proficient) (U.S. Department of Education, 2015).

Prevention of Reading Problems

In recognition of the exponential accumulation of consequences related to early reading failure, there has been an increased emphasis on prevention and early intervention. With the passage of the No Child Left Behind Act (NCLB, 2001) which aimed to improve the academic achievement of all students, especially those who are disadvantaged, the federal government placed focus on high quality early reading intervention. Soon after, the reauthorization of the Individuals with Disabilities Education Act (IDEA, 2004) specifically endorsed service delivery models that identify young children at risk for reading difficulty and provide research based early intervention.

Research supports the notion that the poor trajectories of reading development for students can be prevented by providing effective core reading instruction for all students, and by targeting at-risk children for early intervention (Snow et al., 1998). Torgesen (1998) noted that the majority of children who fail to reach reading proficiency by later elementary school demonstrate early weaknesses in phonological awareness and in turn, difficulty applying the alphabetic principle to identify words. In the study described previously, Juel (1988) found that poor phonemic awareness among first-grade participants contributed to the poor outcomes in fourth grade. Explicit instruction in phonological awareness and decoding skills have been shown to benefit all students, but especially those at highest risk (Foorman, Francis, Fletcher, Schatschneider & Mehta, 1998; National Institute of Child Health and Human Development (NICHD), 2000). Research supports the hypothesis that for some at-risk students, intensive reading intervention in the early grades can act as a sort of "inoculation", providing protection against reading failure and negating the need for additional intervention as long as

evidence-based core reading instruction continues to be provided (Coyne, Kame'enui, Simmons, Harn, 2004). As an example, researchers followed the literacy development of 41 low income second graders from minority groups who had participated in an explicit phonemic awareness and phonics intervention in kindergarten (Cartledge, Yurick, Singh, Keyes, & Kourea, 2011). They found that many students, who were initially identified as at risk according to kindergarten assessments, were able to reach benchmark goals by second grade, and even surpassed their peers who were considered not to be at risk in kindergarten. By second grade, 62% of students who received one year of intervention met benchmarks, while only 45% of the control group met benchmarks.

In schools, prevention and intervention initiatives are commonly situated within a Response to Intervention (RTI) approach. RTI is an intervention decision-making model that depends upon a multi-tiered framework of service delivery in which schools prevent, identify, and address learning problems (Fuchs, Mock, Morgan & Young, 2003; Fletcher & Vaughn, 2009; Lembke, McMaster & Stecker, 2010). At the preventative foundation, evidence based core instruction meets the needs of a majority of students (Tier I), while targeted support is provided to students who are not successful with the core program (Tier II). Finally, intensive interventions are provided to a small percentage of students with the greatest need (Tier III). When implemented with fidelity, students receive intervention that is consistent with their needs. However, successful implementation of RTI practices is contingent upon useful data to guide decision-making at each level. Torgesen (1998) outlined the critical elements of systems designed to prevent reading problems, including: "(a) the right kind and quality of instruction delivered with the (b) right level of intensity and duration to (c) the right children at the (d) right time" (p. 3).

By exploring the ways that elementary schools identify first-grade children in need of intervention beyond Tier I core instruction, the current study focuses on the latter two critical elements – the right children at the right time.

Accountability and Assessment

In response to trends in reading achievement and in recognition of the efficacy of preventative reading instruction, there has been an increased focus in recent decades on assessment and accountability. Under the NCLB Act (2001), states were mandated to assess and report the reading proficiency of students beginning in third-grade. The high stakes state tests that emerged from this accountability movement are summative assessments, and while important for measuring the progress of student populations and evaluating the overall effectiveness of schools, these tests do not necessarily provide information that is useful for guiding timely educational decisions for individual students (Shinn, 1989). Because of this, the NCLB Act also recommended the use of screening practices to identify students at risk for reading difficulties in early elementary schools. As part of RTI and prevention-oriented practices, and in response to the accountability requirements of the mandate, educators have increasingly sought ways to identify students in need of support far earlier than third-grade, which was common in the wait-to-fail models of the previous decades. Now educators seek to identify students as early as kindergarten to provide them with critical early literacy instruction to counteract the Matthew Effects in as timely a manner as possible.

As more and more accountability innovations are recommended to educators to improve educational practices, valuable resources are expended on assessment activities. The Standards for Educational and Psychological Testing, developed jointly by the

American Educational Research Association (AERA), the American Psychological Association (APA), and the National Council on Measurement in Education (NCME), outline considerations for sound and ethical use of testing practices (AERA, APA & NCME, 2014). The Standards note that test scores should be interpreted in the ways for which they have been validated, recommending parameters for test developers, who must, "set forth clearly how test scores are intended to be interpreted and used," as well as obligations of the test user, who must be prepared to provide evidence of technical quality when using the assessment for purposes not validated by the test developer.

School psychologists play an important role in prioritizing which assessments are most effective and efficient for answering questions that need to be answered. School psychologists are not only adept in administering and interpreting, but also evaluating the use of assessments for a variety of purposes. Based on the work of the National Reading First Assessment Committee (Kame'enui, 2000), Coyne and Harn (2006) describe four purposes for assessment within a school wide early literacy system. These include: screening, progress monitoring, diagnosis, and measuring student outcomes. Assessments administered for each of these purposes aim to answer specific questions related to the given purpose.

Screening assessments, which are the focus of the current study and discussed in detail in following sections, seek to identify children who are at risk for later reading difficulties and who should receive additional intervention. Assessments used for the purpose of progress monitoring are used to make idiographic decisions to determine whether individual students are making adequate progress to meet their respective goals, and to evaluate whether interventions are working for their specific needs. Data from

diagnostic assessments provide information about students' specific skills and deficits to inform instructional decisions such as student grouping, learning objectives and intervention targets. Finally, data from student outcome assessments guide system-level decisions regarding the school's reading curriculum and instruction by answering questions related to the overall effectiveness of the school's reading program.

The National Association of School Psychologists (2009) similarly outlines the ways that assessment data should be used to guide educational decision-making at multiple levels, and draws a distinction between low stakes and high stakes decisions. Low stakes decisions are routine and reversible, such as the decision to use a particular instructional technique in the classroom. These decisions are generally guided by less formal forms of assessment. High stakes decisions, in contrast, are made less frequently and are more difficult to reverse, such as decisions about retention or special education eligibility. Along this spectrum of low to high stakes decision-making, information obtained from assessments is used for routine classroom level decisions, as well as for problem identification, for problem definition and certification, for problem analysis and intervention planning, for program evaluation and accountability, and for diagnostic and eligibility decisions.

Universal Screening

Screening is one purpose of assessment, and is an essential component of RTI (National Center on Response to Intervention, 2010). Kettler, Glover, Albers, and Feeney-Kettler (2014) offer a comprehensive definition of screening:

> "We define *screening* as the use of a test or other evidence to make broad categorizations of examinees to (a) identify which students would benefit from

> preventive interventions and (b) determine whether school-based instructional or behavioral assistance are meeting students' needs. Accordingly, screening involves brief assessments conducted with all students (i.e., universal screening) or with targeted groups of students to identify individuals who are at risk for future difficulties as well as to evaluate existing practices." (p. 7)

This definition highlights the importance of using screening data not only to identify specific students in need of intervention, but to evaluate the effectiveness of classwide or schoolwide instructional practices. For example, if large numbers of students are identified as at-risk for reading problems, then educators can respond to the results of the screening data and alter the educational practices for better results. Further, the focus of the data-based decisions is on the relationship between each student and his or her instructional environment, providing educators with information regarding how to meet students' needs. Thus, screening data are used to formulate critical decisions about programming for learners, rather than for providing evidence about disabilities and their subsequent labels.

It is crucial that educators make knowledgeable decisions when selecting from the screening measures available to them and when the interpreting data elicited from the screening process. Glover and Albers (2007) identified three important considerations for evaluating the utility of assessments used as universal screening tools. These include: *appropriateness for intended use*, *technical adequacy*, and *usability*. Within the authors' heuristic, information to be considered when evaluating appropriateness for intended use includes compatibility with local service delivery needs, alignment with constructs of interest, theoretical & empirical support, and population fit. Attending to these practical

characteristics ensures that screeners are appropriate for the context and purpose for which they will be used. Jenkins, Hudson and Johnson (2007) similarly stress the importance of ensuring that instruments are aligned with constructs of interest, meaning that screening tools should "target reading or reading-related skills that are pertinent to the grade and time the screen is administered" (p. 585).

When considering technical adequacy, Glover and Albers (2007) highlight the need for choosing instruments that have demonstrated evidence of reliability and validity. One type of validity, *predictive validity*, is arguably the most important gauge of technical adequacy for a screening tool. It refers not only to the strength of the correlation between the screening measure and a criterion measure administered at a later date, but also encompasses *classification accuracy*, the ability of the screening measure to accurately identify students as at risk in the domain (Jenkins et al., 2007).

Finally, Glover and Albers (2007) note that even when an assessment is determined to be appropriate and have adequate technical properties, it must also be evaluated for usability, including efficiency in terms of cost, time and resources, acceptability to stakeholders, and utility of outcomes.

First-Grade Screening Tools

Although universal screening typically begins upon school entry, kindergarten screening tools often result in unacceptable levels of false positive classifications (Compton, Fuchs, Fuchs, & Bryant, 2006). Based on their review of research related to early identification of reading disabilities, Ritchey and Speece (2004) argue that classification accuracy of screening measures may be improved by screening in first-grade, rather than kindergarten. They speculate that developmental factors, including

adjustment to the demands of the classroom and rapid acquisition of skills, may make universal screening of reading skills in kindergarten less reliable than in first-grade. Compton et al. (2006) suggest three reasons why first-grade screening procedures result in more accurate classification. First, the developmental skills targeted by screening measures administered during the first-grade year, such as word reading, are more closely aligned with overall reading ability. Second, core instruction in kindergarten may reduce the variability in skills between students based on various literacy experiences prior to schooling. And finally, variability observed due to within-child error decreases with age. In the current study, beginning and mid-year first-grade screening tools are examined. These important benchmarking periods, typically occurring in September and January, are situated in such a way that all children have had exposure to core literacy instruction in kindergarten, yet several months of the school year remain to make educational decisions based on screening results.

Curriculum Based Measurement

Curriculum based measurement (CBM) is an assessment method commonly used for a variety of purposes within RTI frameworks (Deno, 2003). CBM refers to a set of standardized procedures to index student performance in academic skill areas such as reading. In contrast to norm-referenced tests such as those used by states for the purposes of accountability, CBM tools are highly aligned to curricular expectations, and can be used formatively to make instructional decisions throughout the year. CBM was originally designed as a progress monitoring model to formatively evaluate the effectiveness of instruction for students in special education programs (Deno & Mirkin 1977), but in recent decades CBM tools have been increasingly adopted by school

systems for the purpose of screening (Deno, 2003). Due to cost and time efficiency, CBM methods have become the most common method of universal screening in RTI settings (Ball & Christ, 2012). Over the course of the academic year, first-grade CBM screening tools typically measure phonemic awareness, letter sound knowledge, decoding, word identification, and text reading (Jenkins et al., 2007). One set of CBM tools, the Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Kaminski & Good, 1998) has been identified as the most prevalent screening instrument for identifying at risk students in early elementary school (Johnson, Jenkins, Petscher & Catts, 2009). A comparable set of measures, the Aimsweb Tests of Early Literacy (TEL; Pearson, 2014) operationalize and measure the behaviors associated with these foundational early reading skills, and are also commonly used as first-grade screening tools (National Center on Intensive Intervention, 2014).

The Aimsweb TEL are comprised of four subtests, including letter naming fluency (LNF), letter sound fluency (LSF), phoneme segmentation fluency (PSF), and nonsense word fluency (NWF). All four measures are typically administered during the fall of first-grade benchmarking period. In the winter benchmarking session, students are screened using PSF and NWF, as well as Reading Curriculum Based Measurement (R-CBM), or Oral Reading Fluency (ORF). There is abundant research that demonstrates the relationship between R-CBM and high stakes tests administered in close proximity to one another (e. g. Ball & O'Connor, 2016; McGlinchey & Hixon, 2004; Shaw & Shaw, 2002; Stage & Jacobsen, 2001), as well as evidence that R-CBM performance can predict later performance on state tests (e.g. Silberglitt and Hintze, 2005). While the research on predictive validity and classification accuracy of R-CBM with respect to high stakes

assessments is well established, there is less literature demonstrating the longitudinal utility of individual subtests of the TEL.

With respect to Glover and Albers' (2007) considerations for screening tools, first-grade Aimsweb measures are generally aligned with constructs of interest (phonemic awareness, alphabetic principal, fluency) in predicting the trajectory of reading development, making these tools arguably appropriate for the purpose of screening. In addition, the format of CBM tasks enjoys theoretical and empirical support. The Aimsweb measures also demonstrate usability, in that they are efficient and cost effective to administer. While there is some empirical support for the technical adequacy of the Aimsweb measures as a screening tool in first-grade, as will be detailed in the following chapter, they often do not approach the levels of classification accuracy recommended by Glover and Albers (2007). However, the mere existence of this research allows educators to carefully consider how they will be used. For example, a school might choose to use a combination of screening tools to increase predictive validity, or might use further progress monitoring to reduce the consequences of high false positive rates.

Informal Reading Inventories

Whereas districts wishing to evaluate the use of specific CBM tools as screeners may turn to any number of the studies described in the following literature review, very little research has been published on informal reading inventories (IRIs), assessments that are also commonly used to determine which students are likely to require intervention. IRIs are individually administered reading assessments in which a teacher observes a child reading. They were originally designed as a structured observation tool for teachers to read with their students and identify reading levels and targets for instruction (Pikulski,

1974), and according to some authors should be thought of as flexible strategies, rather than tests (Johnson, Kress & Pikulski, 1987). However, many school districts use IRIs as screening instruments to identify students in need of supplemental instruction, report the reading levels elicited from these assessments as a summative measure of early reading, and use their results as the basis of high stakes decisions (Paris, 2002). Paris and Carpenter (2003) identify early detection of reading problems as among the most important purposes of IRIs. However, the test properties of IRIs, including reliability and validity, have been poorly documented and have been questioned (Spector, 2005; Ball & Christ, 2012; Burns, Haegele & Petersen-Brown, 2014).

One example of a commercially available IRI is the Developmental Reading Assessment, 2nd Edition (DRA2; Pearson, 2011a). The earliest levels of the DRA2, used to assess emergent readers in early first-grade, prompt students to read from highly patterned text with predictable language structures and picture support for each sentence. The critical foundational skills consistent with the developmental stage of an emergent reader, including phonemic awareness and decoding skills, are not explicitly measured through this assessment. However, later levels of the DRA2 incorporate a measure of oral reading fluency, in alignment with the development of text-level fluency expected during the latter part of the first-grade year.

In a review of the DRA2, McCarthy and Christ (2010) noted that the assessment has strong face validity, yet it is lengthy to administer, especially when students must read from multiple texts to find the appropriate level. Further, benchmark expectations are not clearly developed, and administration and scoring procedures were found to be complicated and exposed to subjectivity, meaning that extensive training must be

provided to teachers and other test administrators. This, in conjunction with publisher reported reliability statistics that are insufficient for high stakes decisions led McCarthy and Christ (2010) to recommend against its use as a screening tool.

Very few published studies have investigated the technical properties and decision-making utility of IRIs, and those that do call into question the diagnostic accuracy of these tools for second and third-grade students (Klingbeil, McComas, Burns and Helman, 2015; Parker et al., 2015). To this author's knowledge, no published studies have investigated the use of IRIs for the purpose of screening in first-grade.

Considerations for Screening Diverse Populations

Critically important to the validation of a screening tool is attention to whether adequate classification accuracy is achieved across subgroups of students. Although there is limited research in this area, there is evidence that even when screening tools have demonstrated predictive validity, this important technical property might not be consistent across specific populations of students. Hosp, Hosp and Dole (2011) found that the predictive validity of NWF and R-CBM varied by subgroups including economically disadvantaged students, English learners, students with disabilities, and racial groups, suggesting that cut scores developed based on overall classification accuracy might misidentify students in these groups. Others have found that lower NWF and ORF cut scores were necessary for English learners and those who qualified for free or reduced lunch, and have recommended disaggregating screening data to ensure access to tier II interventions (Johnson et al., 2009). Similar research on the use of a preschool vocabulary screening measure supported the use of alternative cut scores for screening tools used with English learners (Marcotte, Clemens, Parker, & Whitcomb, 2016).

Purpose of the Current Study

While there is research support for the use of R-CBM to predict later reading achievement, as well as some support for the use of other Aimsweb TEL measures to predict later outcomes, research of this type has not been conducted with IRIs. The primary purpose of the current study is to attempt to hold one IRI, the DRA2, to the same standards of appropriateness of intended use, technical adequacy, and usability as other screening measures. Despite the limited research base, IRIs such as the DRA2 are widely endorsed by teachers (Nilsson, 2013a) and are frequently used as screening tools in schools implementing RTI (Mellard, McKnight & Woods, 2009). As the uses of IRIs have evolved since they were originally developed, there has been little formal investigation into the changing ways that teachers are using IRIs to organize their contemporary RTI practices. The current study was designed to understand the purposes for which first-grade educators use IRIs and early reading CBM measures, and to evaluate the validity of these uses in light of the characteristics of appropriateness, usability, and technical characteristics, specifically predictive validity and classification accuracy.

Research Questions

To evaluate the appropriateness, usability, and predictive validity of the DRA2 and Aimsweb TEL measures, as well as the validity of interpretations that teachers make based on these tools, the following questions were tested.

Part 1: Appropriateness for Intended Use and Usability

1. Do the constructs targeted by fall and winter first-grade Aimsweb and DRA2 reading assessments align with reading related-skills that are germane to the risk

and resiliency factors for reading problems that have been identified by theoretical and empirical support?

2. What is the usability evidence for first-grade Aimsweb and DRA2 reading assessments? For example, how efficient is each screening method in terms of cost, time and resources, and acceptability to stakeholders?
3. What inferences do first-grade classroom teachers, special educators & reading specialists in one school district make based on the results of fall and winter first-grade Aimsweb and DRA2 reading assessments?

This first set of research questions addresses the appropriateness for intended use, and usability (Glover & Albers, 2007) of each reading assessment. Qualitative analyses were used to examine the content and format of each assessment, referencing the constructs within with theoretical and empirical support. The following chapter will expand the discussion of which constructs related to early reading acquisition are supported by empirical research and which are debated. Chapter 2 also includes a critical analysis of the constructs of each test as a first step to validating their use as screening tools. In addition to content analysis of each set of measures presented in Chapter 2, educator input was solicited as part of an inquiry into the intended use of each assessment, as well as the usability of each set of measures.

Part 2: Testing the Technical Adequacy of First-Grade Screening Measures

4. How much variability in third-grade state standardized test reading scores is predicted by fall and winter first-grade performance on the DRA2 and the Aimsweb TEL measures?

5. What is the classification accuracy of the fall and winter first-grade DRA2 and Aimsweb screening measures for this sample using published cut points for risk? Using a logistic regression approach to establish cut points for risk status, can classification accuracy of each measure be improved for this sample?
6. How does classification accuracy differ for subgroups including English language learners and students who are eligible for free or reduced lunch?

This second set of research questions addresses the technical characteristics of the screening tools. While some aspects of technical adequacy, including norm group information, reliability, and concurrent validity are reported by the publisher are explored further as part of the content analysis of each measure, these research questions focus on the *predictive validity* of screening measures administered in the fall and winter of first-grade. The use of existing data, gathered by teachers and other educators as part of one district's screening protocol, allows for testing of the robustness of the validity of decisions made by schools based on actual data, gathered in a fashion consistent with typical practice in elementary schools that implement universal screening programs.

Part 3: Integration of Qualitative and Quantitative Data

7. Are the inferences and decisions made based on screening results supported by the constructs assessed by each measure and by the predictive validity evidence?

Finally, qualitative and quantitative data will be synthesized to make a broad judgment regarding the utility of the first-grade Aimsweb and DRA2 as screening tools in the participating school district.

CHAPTER 2

REVIEW OF THEORETICAL AND EMPIRICAL LITERATURE

Introduction

Early screening for reading problems is an essential component of elementary prevention and early intervention programs. Data from screening assessments are used to determine if core instruction is meeting the needs of the majority of students, and to determine whether further assessment & intervention may be indicated for students who are likely to struggle. Central features of effective universal screening tools include efficient administration, suitability for repeated administrations over the course of a school year, strong technical properties related to predictive validity, and above all, the ability to elicit data that can be used to make instructional and curricular decisions that benefit students (Kettler et al., 2014).

When school personnel seek screening tools, there are numerous options available to them, and it is common for educators to choose assessments based on information provided by the publisher and their advertisements, without fully considering important characteristics and contextual fit (Parisi, Ihlo, & Glover, 2014). Several scholars have suggested critical considerations for educators wishing to ensure that the data collected through universal screening can effectively guide service delivery to support young readers. For example, Parisi et al. (2014) suggest the following critical questions:

- *Has the instrument been designed & validated for the purpose of screening?*
- *Do the measured indicators align with service delivery needs in the school? If so, are the indicators specific enough to determine whether students are*

meeting benchmark expectations or are in need of additional instruction or intervention?

- *Is the timing & frequency of administration appropriate for identifying instructional or intervention needs?*

These questions are based on the comprehensive conceptual framework developed by Glover and Albers (2007) as a result of their review of contemporary universal screening science literature. The authors organize important considerations for evaluating screening assessments into three broad factors: (1) appropriateness for the intended use, (2) technical adequacy, and (3) usability, encouraging readers to use the framework to advise school personnel who are adopting universal screening tools, as well as to focus future research related to screening. Using evidence from the literature and the assessment materials themselves, in this chapter the Glover and Albers (2007) framework will be used to evaluate the two types of first-grade reading assessments to be investigated in the current study: early literacy CBM, as typified by the Aimsweb TEL and R-CBM, and informal reading inventories, as typified by the DRA2. A brief discussion of each consideration described by Glover and Albers (2007) will be followed by evidence from test publishers, as well as independent theoretical or empirical evidence to support alignment with important features of screening tools for first grade readers.

Historical Perspectives on Early Reading Instruction

A chief consideration is whether the constructs targeted by screening tools align with the constructs that predict later risk. Screening tools that identify risk of later reading problems accurately estimate the reading-related constructs relevant to specific developmental reading stage at the time of administration, demonstrating sensitivity to

the skills relevant to the grade level and at each assessment period over the academic year (Jenkins et al., 2007). Before exploring the typical reading trajectory of first-graders and enumerating the characteristics that are indicative of later reading success or failure, it is worthwhile to briefly review historical reading research and examine the competing models of the reading process that have resulted from these investigations, and more specifically, to examine the ways each model has informed competing perspectives on assessment and instruction for developing readers.

The first formal review of the history and scientific study of reading development was published in 1908 by psychologist Edmund Burke Huey (Walczyk, Tcholakian, Igou, & Dixon, 2014). Huey argued against the use of direct instruction to teach reading, and rather recommended that the focus of reading instruction be on exposing children to engaging literature. Huey and other early 20th century reading experts argued that phonics exposure should be incidental, to be discovered in the context of literature, rather than systematically taught in isolation. These scholars based their techniques on the results of early eye tracking studies, which made use of skilled adult readers as subjects. They observed that these practiced readers made saccadic jumps, fixating on whole words and phrases rather than on individual letters or phonics patterns. Further, these studies noted that word identification was stronger in the context of meaningful text (Walczyk et al., 2014). These findings were generalized to beginning readers, leading contemporary reading experts to argue for a whole word reading approach in which students are encouraged to memorize whole words and use syntactic context cues to identify unknown words, and against the direct instruction of sound symbol correspondences.

In 1955, Rudolph Flesch offered a refutation of whole word approaches in *Why Johnny can't Read- And what you can do about it* (Flesch, 1955). Flesch systematically contested research, such as the studies of proficient adult readers described above, that was used to support whole word, or "look-say" methods of reading instruction. He contended that, "in every single research study ever made phonics has shown to be superior to the word method; conversely, there is not a single research study that shows the word method superior to phonics" (p.60). Flesch advocated for teaching approaches that introduce phonetic rules, "letter by letter and sound by sound" beginning at age five or six. Despite the popularity of Flesch's text among American parents, many reading educators continued to advocate for a whole word approach, and the modern "whole language" movement continued to grow by the 1970s (Farrall, 2012).

Whole language advocates argue that learning to read is a natural process, much like learning to speak. According to this approach, literacy develops from whole to part, in response to children's social needs. If they are immersed in a literacy rich environment, children will learn how to draw upon various cueing systems to create meaning from text (Goodman, 1986). Beginning readers in whole language classrooms read familiar, predictable, illustrated texts that allow them to draw upon background knowledge to comprehend. Like their whole word proponent predecessors, whole language advocates argue against the teaching of discrete reading skills in isolation (Edelsky, Alterwerger & Flores, 1991).

Models of the Reading Process

The competing theories described above have advanced several models of the reading process which can be helpful in understanding the theoretical perspectives

involved in distinct approaches to reading instruction and assessment. According to a psycholinguistic model of reading (Pearson, 1976), which is consistent with whole language methodology, readers draw on three sources of information to identify words in text: *semantic*, or knowledge of word meanings; *syntactic*, or knowledge of grammatical structures; and *graphophonic*, or knowledge of sound symbol correspondences. This model, commonly referred to as the *three-cueing system* (Adams, 1998) asserts that efficient readers rely most heavily on semantic and syntactic clues, and minimize their reliance on graphophonic cues. As described by Goodman (1967), according to this model the act of reading is a "psycholinguistic guessing game," in which linguistic knowledge prevails, and the print itself is decoded only as a last resort. Hence, in this model, reliance on graphophonic skills would be behavior indicative of a weak reader.

In contrast, code perspectives on reading offer models that give emphasis to the role of decoding in the reading process. According to the Simple View of Reading (Gough & Tunmer, 1986) reading comprehension is a product of decoding ability and linguistic comprehension ability. More complex models further break down these domains of word recognition and language comprehension into subskills (Scarborough, 2001; McKenna & Stahl, 2009). Word recognition includes phonological awareness, print concepts, and decoding and sight word knowledge, while language comprehension includes background knowledge, semantics and syntax. Further, these models attend to the increasing automaticity of these skills in developing readers. Information processing models of reading, such as that proposed by LaBerge and Samuels (1974) presume that beginning readers expend a great deal of cognitive attention on the act of decoding accurately, leaving few mental resources available for the processes involved in

comprehension. On the other hand, skilled readers automatically process the orthographic and phonological information in the print, allowing for seamless comprehension. In code models of reading development, a young reader who attends to the graphophonic cues would be suggestive of appropriate reading development.

First-Grade Reading Constructs

In response to the contradiction between various approaches to initial reading instruction, Jeanne Chall (1967) undertook a large-scale study in which she critically analyzed existing research related to reading instruction and interviewed proponents with multiple perspectives on what she coined "The Great Debate," or the national discussion of the best approaches to teaching reading. Based on this two year study, Chall came to the conclusion that beginning reading instruction should emphasize the printed code. Chall's later research led her to propose a developmental sequence with the purpose of informing instructional and assessment priorities for children of different ages (Chall, 1996). This widely cited theory of the stages of reading development is useful for identifying the reading skills expected across each stage of reading acquisition, and thus, for evaluating the alignment of measurement constructs for developing readers. Chall described six predictable stages of reading development, from the *Pre-Reading* stage (stage 0; birth- age 6), in which children learn concepts of print such as 1:1 correspondence between spoken words and their respective print in text, use illustrations to tell stories, and recognize environmental print, to the *Construction and Reconstruction* stage (stage 5; ages 18+), the most advanced stage during which adults interpret and respond to abstract text (Table 1). Consistent with the accountability legislation described previously, by the time students complete third-grade they should be prepared for the

Reading for Learning the New stage (stage 3; ages 9-13), which indicates students can read text to learn new concepts and ideas. To ensure that students are progressing through the predictable stages of reading acquisition that will result in *Reading for Learning the New* by third-grade, reading screening procedures for first-graders should address the knowledge and skills involved in stages 1 and 2, indicative of kindergarten, first and second grade reading development. Stage 1(*Initial Reading or Decoding;* ages 6-7) is observed when students learn and apply sound symbol correspondences, including basic letter-sound recognition and more complex letter combination rules to decode words in print. Stage 2 (*Confirmation, Fluency, Ungluing from Print*; ages 7-8) is observed as students begin to automatically apply the phonics skills gained in stage 1 and gain the fluency and speed necessary for comprehension. According to this developmental trajectory, pre-reading concepts have been mastered by the end of kindergarten. First-grade readers are generally developing greater decoding skills, and in the second half of the school year, beginning to demonstrate greater fluency with connected text.

Correspondingly, the four-phase model of sight word development theorized by Linnea Ehri (1987, 2005) offers understanding of how readers acquire the skills necessary to automatically decode complex words. Children in the *pre-alphabetic phase* have little to no knowledge of letter names or sounds, yet learn to recognize print in their environments through other visual and contextual cues such as pictures and graphics in logos. As students begin to learn about letter sound correspondences, they enter the *partial alphabetic phase*, in which they use these correspondences to begin decoding words. In this stage, children often rely on known associations (typically initial and final consonants), and thus alphabetic knowledge is considered "partial". In the *full alphabetic*

phase readers have developed a more complete knowledge of graphophonic connections and can use this information to decode unfamiliar words. Finally, in the *consolidated alphabetic phase,* readers have memorized morphemes and other recurring letter sequences to enable rapid identification of complex, previously unfamiliar multisyllabic words. Throughout these stages, as words are encountered multiple times, they are committed to memory. Once typically developing readers have reached the full alphabetic phase, they only need a handful of successful encounters to recognize a word by sight.

Ehri's work sheds light on the process by which readers move from Chall's stage 1 to stage 2, or in which they move from being "glued to the print" to becoming fluent readers capable of reading previously encountered words by sight, as well as consolidating knowledge of letter sequences to automatically decode unfamiliar words. Both Ehri and Chall argued that for many children, progression through stages of reading development does not occur on its own, and that children identified as having poor reading skills require direct instruction in phonological awareness and the alphabetic principal. Indeed, Ehri (2005) concluded that "phonics instruction promotes more rapid movement from the partial to the full phase than whole-word instruction" (p. 147). Based on the work of Chall (1996) and Ehri (2005), for a screening tool to be deemed appropriate for the purpose of identifying first-graders who may require more instructional support in the area of decoding, it must measure the constructs related to automatic decoding, including knowledge of letter names and sounds, and use of letter sound correspondences to decode novel words.

These developmental reading theories are reflected in the work of the National Reading Panel (NRP; NICHD, 2000), which became the basis for educational policy related to the teaching of reading. The panel reviewed the research literature regarding effective practices for teaching reading, and identified five components of reading development as most critical: Phonological Awareness, Phonics, Fluency, Vocabulary and Comprehension. These findings are in turn reflected in the Common Core State Standards (Massachusetts Department of Elementary and Secondary Education (Massachusetts Department of Elementary and Secondary Education, 2017a), which outline curricular frameworks for foundational skills of Print Concepts, Phonological Awareness, Phonics and Word Recognition, and Fluency, as well as frameworks related to the comprehension of literature and informational texts. These reading standards establish expectations that during the first-grade year, children will: demonstrate understanding of the organization and basic features of print, demonstrate understanding of spoken words, syllables, and sounds (phonemes), know and apply grade-level phonics and word analysis skills in decoding words, and read with sufficient accuracy and fluency to support comprehension. In addition, first-graders are expected to: ask and answer questions about key details of texts, retell stories using key details, identify the main topic of informational texts, identify common genres of text, compare and contrast stories and informational texts, and use text features, including illustrations and details of stories and informational texts to support understanding. They are expected to distinguish between information provided by pictures or other illustrations and information provided by the words in a text. It is understood that for first-graders, instruction focused on these comprehension standards should be primarily based on texts that are read aloud, as most

students will be capable of comprehending stories and informational texts at levels far beyond what they can read independently.

Reading Instruction in First-Grade Classrooms

Today, decades after Chall first formally addressed the opposing perspectives on reading instruction in *Learning to Read: The Great Debate,* the reading science research and resulting policy decisions have converged on the understanding that children should receive explicit, systematic instruction in phonics as part of a comprehensive literacy program (Moats, 2000). Despite negligible evidence to support a whole language approach, the perspective and associated instructional practices remain commonplace in first-grade classrooms. For example, within a Guided Reading approach, commonly used as the core reading instruction for first-grade students (Fountas & Pinnell, 2012), teachers read leveled, minimally decodable texts with small groups of students, focusing on using semantic and syntactic cues rather than graphophonic decoding strategies to induce word identification skills. The developers of the Scholastic Guided Reading Program (Pinnell & Fountas, 2010) note that *all* instruction within this model is designed to teach reading comprehension. However, phonics instruction is noted as an important component of the program, incorporated as follows:

> Guided reading provides the opportunity to teach this kind of problem-solving using phonics and, in addition, may provide one or two minutes of "hands on" phonics and word work at the end of each lesson. Phonics is an active part of the teaching in guided reading: In the introduction, the teacher draws attention to aspects of words that offer students ways to learn how words "work," for example, by point [*sic*] out first letters, plurals, word endings, consonant clusters,

> vowel pairs, or syllables. As students read, the teacher teaches, prompts for, and reinforces children's ability to take words apart. After reading, the teacher may make an explicit teaching point that shows students how to take words apart rapidly and efficiently. The teacher may preplan some specific word work that shows children phonics elements that they need to know to solve words at this particular level of text. Students may learn to hear sounds in words (in sequence), manipulate magnetic letters, or use white boards and dry-erase markers to make phonics principles explicit. (Pinnell & Fountas, 2010, p. 9-10)

The authors note the alignment of their approach to the findings of the NRP, emphasizing the NRP's assertion that phonics is but one component of a literacy program. However, this approach to phonics, to be accomplished in "one or two minutes at the end of each lesson," does not correspond Chall's (1967) recommendation that beginning reading programs *emphasize* learning of the alphabetic code. Further, phonics instruction after students have engaged in the reading of the text, rather than prior to reading, implies the importance of using meaning cues to identify words and the use of phonetic cues as a last resort. In contrast, explicit, systematic phonics instruction, according to the NRP "typically involves explicitly teaching students a prespecified set of letter- sound relations and having students read text that provides practice using these relations to decode words" (NICHD, 2000, p. 2-92).

Considerations for Evaluating First-Grade Screeners

Appropriateness for Intended Use

Assessments used as screening tools must demonstrate appropriateness for the purpose of screening, meaning not only that they measure the constructs that indicate

development and risk factors in the given domain, such as the reading skills described above, but also that they employ an appropriate format and that the data derived from the assessment are used to determine instruction and service delivery within the specific context in which they are to be administered.

Alignment with Constructs

First-Grade CBM Tools

The Aimsweb Technical Manual notes that the TEL measures align to the critical reading skills identified by the NRP (Pearson, 2012c). Indeed, the first-grade Aimsweb measures, which include Letter Naming Fluency (LNF), Letter Sound Fluency (LSF), Phoneme Segmentation Fluency (PSF), Nonsense Words Fluency (NWF), and Reading-Curriculum-based Measurement (R-CBM) are highly aligned to the important constructs identified above. PSF is an indicator of phonological awareness, LNF, LSF and NWF are indicators of the alphabetic principal and decoding skills, while R-CBM an indicator of fluency with connected text. Research supports the premise that NWF, and to a lesser extent LNF, measure important constructs predictive of later reading ability (Speece, Mills, Ritchey & Hillman, 2003). Oral reading fluency, measured by R-CBM is likewise an indicator of overall reading ability (Fuchs, Fuchs, Hosp & Jenkins, 2001). Print concepts, one component of the Common Core State Standards, are not explicitly measured in the first-grade Aimsweb tasks, yet are tacit in the general outcome measure of R-CBM. The Aimsweb tools typically used for first-grade screening do not include an explicit measure of comprehension. Nonetheless, Reading Maze is a reading comprehension task that is available for first-graders as part of Aimsweb. In this assessment, students silently read a passage in which every 7th word is replaced by a

three-word choice prompt from which readers select the correct word for the context of the passage. However, because the ability to read connected text is developing over the course of the first-grade year, Maze is not typically administered as a screening tool until grade 3 and beyond, and was not investigated as a screening tool in the current study. Examples of the Aimsweb TEL probes can be seen in Appendix A.

Informal Reading Inventories

According to the DRA2 technical manual, the test is designed to measure three "critical components" of reading, including reading engagement, oral reading fluency, and comprehension. Factor analysis conducted by the publisher confirms that oral reading fluency and comprehension are indeed two distinct dimensions that are being measured by the DRA2 (Pearson, 2011c). The third component, reading engagement, is a qualitative indicator that is not taken into account when determining a child's score, or reading level. In levels A through 3 of the DRA2, oral reading fluency is assessed by observing and rating three components - *Monitoring/Self Corrections*, *Use of Cues*, and *Accuracy* – on a Likert-type scale. In these levels, "Printed Language Concepts", including directionality, one to one correspondence, and the child's demonstrated understanding of the meaning of the terms *word, begins, ends, letter* and/or *sound* is measured in lieu of comprehension. At levels 4 through 12, oral reading fluency is assessed by evaluating the student's use of four components - *Correct Phrasing*, *Monitoring/Self-correction*, *Problem Solving Unknown Words*, and *Accuracy*. At levels 14 and beyond, oral reading fluency is measured by rating the student's use of Expression, Phrasing, Rate, and Accuracy. The comprehension components assessed at

levels 4 and beyond include making predictions from text features such as the title and illustrations, retelling, and responses to questions related to interpretation and reflection.

Decoding and word identification are incorporated in levels A-3 as *Use of Cues* (including pictures, sentence pattern and visual information), and levels 4-12 as *Problem Solving Unknown Words*. The teacher later completes an analysis of errors (called miscues), indicating whether they were self-corrected, whether they interfered with meaning, and how the student attempted to problem solve unknown words. A sample DRA2 Teacher Observation Guide from texts typically read by mid-year first-graders is presented in Appendix B.

The DRA2 also includes a word analysis assessment that includes phonological awareness tasks such as rhyming, alliteration and segmenting, and phonics tasks such as encoding, decoding, and syllabication. However, this aspect of the DRA2 does not appear to be routinely administered and is not commonly used to make determinations about students' predicted risk or resiliency when screening reading ability. The publisher recommends that teachers use results of the DRA2 leveled text to determine whether or not to administer the Word Analysis Task. The assessment is not intended for students who are "meeting established levels of proficiency" (Pearson, 2011c). The DRA2 Word Analysis was not administered in the participating school district for this study.

Based on this review of the assessment's content, it appears that the DRA2 is most closely aligned with a psycholinguistic perspective on reading. In Level 3 of the DRA2, which is the expected level for students to read independently in the fall of first-grade, oral reading is supported and assessed by student's use of illustrations and predictable text (the first page is read by the teacher). At Level 8, which students are

expected to read independently in the winter of first-grade, oral reading continues to be supported by predictable text and illustrations on every page, and comprehension is measured by recording the students' retelling of the story and noting use of details, ability to retell in sequence, and use of important vocabulary from the text. These elements of reading are indeed reflected in the Common Core State Standards, yet do not measure students' progression through the decoding stage of reading development. Oral language skills have been shown to be predictive of later reading (Roth, Speece & Cooper, 2002) and are likely encompassed in the retelling task. The constructs of phonological awareness and phonics identified as critical to first-grade reading instruction and assessment are not explicitly measured by the DRA2.

Format of Screening Tools

The theories of reading reviewed above have implications for assessment of first-grade readers, not only in terms of test content, but also in terms of item format. Early literacy indicators that represent the big ideas of phonological awareness, alphabetic understanding, and accuracy and fluency with connected text are measured via CBM probes. The probes can be administered repeatedly to measure a child's growth towards an expected outcome. Therefore, each probe is equivalent so that growth can be seen across benchmarking periods. The fluency with which children demonstrate skills is central to this assessment approach as the raw score gains elicited during each one-minute testing procedure reflect the cognitive acquisition of mastery of the subskills that are measured. Consistent with cognitive theories of automaticity, rapid response rates in fluency tasks can be interpreted as an indicator of learning. In this way, R-CBM has been demonstrated to be an indicator of not only efficiency of word identification, but also of

overall reading competence, including comprehension (Fuchs et al., 2001) because of underlying fluency in skill acquisition. Similarly, the fluent performance on measures of component skills can predict later performance on more advanced component skills, and ultimately on overall reading proficiency (Good, Simmons & Kame'enui, 2001).

Critics of early literacy CBM take issue with the "reductionism" of using a single one minute measure, such as NWF, to measure knowledge of the broader skill of alphabetic principal. There is fear that CBM leads to instruction that focuses on component skills rather than broad reading skills that facilitate understanding, and that the timed component leads students to focus on speed rather than accuracy and meaning (Goodman, 2006). However, the DIBELS authors point out that arguments against the use of these tools are based largely upon misconceptions about the purposes of the assessment, and subsequent misuse by educators (Kaminski et al., 2007).

Whole language proponents tend to favor a more "naturalistic" approach to assessment, in the form of anecdotal observations and checklists (Cambourne & Turbill, 1990). Goodman (1986) describes "ongoing kid-watching," or careful observation of children as they read and write, or converse and play with peers, as the most effective assessment tool that whole language teachers have at their disposal.

Published IRIs typically require students to read leveled passages and respond to a series of comprehension questions. At least some of the text is generally read aloud by the student to the teacher, who completes a running record to evaluate the student's accuracy and interpret errors, referred to as miscues. Fundamental to the format of IRIs is Betts' (1946) system of reading levels. A student's *independent* reading level is the highest text readability that a student can independently read with greater than 90%

comprehension, and greater than 99% accuracy, while the *instructional* level is the highest level of text that the student can comprehend at a rate of at least 75%, and read with at least 95% accuracy. This level of text was thought to be appropriate for instruction. Finally, a student's *frustrational* level would be that at which comprehension is less than 50%, and accuracy less than 90%. A student's "score" on most IRIs is reported in terms of his independent reading level. For example, on the DRA2, the IRI used in this study, first-graders are expected to progress from an independent level 3 in the fall, to a level 8 in the winter, and a level 16 in the spring.

Another integral aspect of IRIs is the use of a running record to document observations about a student's oral reading. Miscues are analyzed to determine whether the error preserves meaning, either interfering with comprehension or not. Miscue analysis (Goodman, 1969), based on the aforementioned three cueing system, is a commonly used approach to reading assessment in whole language classrooms, and manifest in many IRIs. Based on the psycholinguistic perspective of reading, errors that preserve the meaning of the text are considered less problematic than those that interfere with meaning. IRI leveled passages or texts are frequently illustrated, allowing the child to use pictures to confirm text as one of these cueing strategies. After reading, students are typically expected to retell what they have read, or respond to literal and inferential questions about the text.

In recent years, perhaps in response to the identification of fluency as an essential component of reading and a pivotal marker in the development of proficient reading, many published IRIs, including the DRA2, have added a timed component, in which the teacher times the student for a portion of the text. The DRA2 introduces the fluency

component at level 14, typically achieved in the early spring months of first-grade. This practice aligns with typical reading development of first-graders, who are commonly beginning to read connected text by the middle of the year. However, the assessment has no measure of automaticity of skills for students prior to level 14, instead relying on the word reading accuracy, expression and phrasing to inform the oral reading fluency portion of the test. There is evidence that measuring oral reading rate distinguishes between high and low ability readers with better precision than measuring accuracy (Fuchs et al., 2001). Therefore, a tool that does not take fluent response rate into account may not be as sensitive in distinguishing between students who are or are not at risk of reading problems in later elementary school. Additionally, because this fluency portion of the assessment is not introduced until the end of first-grade, it has limited utility for providing preventative instructional support in an RTI model.

Local Compatibility

Finally, when addressing the prerequisite of appropriateness for intended use, schools should consider the compatibility of the assessment tool with the local population, as well as the specific service delivery needs of the school (Glover & Albers, 2007). The screening tool should be appropriate both to the developmental needs of the population, and the contextual factors of the setting. Within this consideration, it is important to take into account the needs of diverse respondents. Evidence that the tool is appropriate for various students can be found by again examining the theoretical and empirical support, and by carefully assessing the normative sample used in standardizing the measure. Additionally, the timing and frequency of administration of screening measures should provide timely evidence that can be used to make instructional decisions

across all tiers of service delivery within an early elementary preventative reading program. That is, the tool should be able to predict various levels of risk among the total population of students, rather than merely those most likely to succeed on later outcomes and those with the most profound reading disorders.

Aimsweb provides expected performance scores for each benchmark assessment period for each assessment in its suite. The scores can be used to interpret the performance of individual students in relation to performance expectations. These default cut scores were developed based on norm groups in the range of 25,000 – 70,000 students depending on each subtest. This sample was comparable to the U.S. population in terms of gender, race, and free or reduced lunch status. English learner information is not included for this sample, but ELL norms have since been developed by the publisher (Pearson, 2012b). In contrast, the DRA2 expectations and reading level benchmarks were not established as the result analyzing of norm group performance, but rather, they are based on the expert judgement of 11 teachers for kindergarten through second grade benchmarks. The technical manual references the use of data from 29,000- 65,000 students (depending on grade level) from the DRA2 Online Management System to confirm the teacher established benchmarks. These data are not presented in the technical manual, yet it is asserted that, "in all cases, teachers felt that the national data confirmed the cutpoints they had established. (Pearson, 2011c, p.52).

The Aimsweb publisher (Pearson, 2012c) acknowledges that the tools may not be a valid measure of early reading skills for all students, such as those with severe speech or vision impairments. The TEL administration guide lists several acceptable accommodations, including enlarging print on the probes, repeating instructions, or

modifying the environment. When screening English learners, norms are available for the TEL and R-CBM which compare students to students at similar level of English proficiency. The DRA2 technical manual does not make reference to accommodations for students with disabilities, with the exception of the suggestion that depending on specific needs, students with IEPs be allowed to dictate responses to written retelling and question tasks in levels 28 and above. The technical manual does not make reference to English learners except in discussion of validation of the Word Analysis Task.

Both Aimsweb and the DRA2 purport to provide information regarding various levels of risk. The Aimsweb default cut scores identify students by level of need in a multi-tiered system of supports, with students above the 35th (45th for R-CBM) percentile according to national norms considered Tier 1, and not at risk, students below the 15th percentile considered tier 3 – in need of intensive support, and those in between, tier 2 (Pearson, 2011b). The DRA2 similarly provides cutpoints for independent, instructional (in need of additional support), and intervention (in need of intensive support). The DRA2 recommends that students not be tested more than one year above grade level according to end of the year cut scores, meaning that there is a ceiling for very advanced readers (Pearson 2011c).

The first-grade Aimsweb measures are meant to be administered as screeners during three benchmarking periods in the fall, winter and spring of the school year. There are 30 progress monitoring forms of each measure in addition to the benchmark probes. The DRA2 is designed to be administered "annually or semiannually in the fall and spring", and the publisher notes that, "it can also be administered more frequently to identify students needing intervention and monitor their progress" (Pearson, 2011c, p.

27). For most levels of the DRA2, two benchmark assessment books are available, with nonfiction texts available for levels 28 and greater.

Adequacy of Technical Characteristics

Adequacy of Norms

Educators wishing to evaluate the utility of screening tools should first look for evidence that the normative sample used to standardize the measure is reflective of the target population. The normative sample should be representative in terms of gender, age, grade, race and ethnicity, socioeconomic status, and disability. The norms should also be recent and the sample of an adequate size to allow valid interpretations to be drawn.

As described previously, the Aimsweb normative sample ranges from roughly 25,000-70,000 depending on subtest. This norming information was collected during the 2009-2010 school year. Despite the apparent availability of similar magnitude of data in the DRA2 Online Management System, the test was not standardized using a norming group. The technical manual describes the sample of students used for field tests in 2006 (1676 students) and 2007 (1084 students). This sample, which is also roughly characteristic of the larger U.S. population, was used to analyze some, but not all of the reported investigations of reliability and validity.

Reliability

Reliability refers to the consistency of measurement under differing conditions (Thorndike, & Thorndike-Christ, 2010). Indicators of reliability include test-retest reliability, alternate form reliability, internal consistency reliability, and interrater reliability, reported as correlation coefficients that range from 0-1. Values of .70 to .80 are generally acceptable for screening decisions, with values above .90 expected when

the tool might be the basis of high stakes decisions. (Salvia & Ysseldyke, 2004, Christ & Nelson, 2014).

CBM tools have a demonstrated record of reliability for their performance level scores, appropriate for screening decisions, albeit not consistently at the level required for higher stakes decisions (Good et al., 2001; Elliott, Lee, & Tollefson, 2001). For R-CBM, Aimsweb reports alternate form reliability of .95 for fall and winter first-grade administrations, and interrater reliability of .99. Based on a sample of 75 kindergarten students, for the TEL subtests, reliability estimates of .80-.94 are reported depending on subtest and reliability type. DIBELS Next reports similar reliability levels for probes identical to the Aimsweb probes, with interrater reliabilities above .96, and alternate form reliabilities above .94 (Dewey, Powell-Smith, Good, & Kaminski, 2015).

The reliability of IRIs has been questioned for some time (Pikulski, 1974; Klesius & Homan, 1985). Spector (2005) examined reliability evidence from nine IRIs (not including the DRA2). She found that fewer than half of the IRI publishers did not report any reliability information at all, and went as far as to suggest that "failure to address reliability appears to reflect a considered decision by some IRI authors to ignore widely accepted professional standards of test quality" (p. 599). While some IRIs did mention reliability, their studies had weak methodology marked by small sample sizes, and poor documentation of methods in general. A later replication of Spector's study (Nilsson, 2013b) found that the reporting of reliability in IRI manuals had improved, but was not consistent across measurement tools.

In reporting internal consistency, The DRA2 technical manual reports separate Cronbach's alpha estimates for the two constructs of oral fluency and comprehension,

reporting levels .62-.85 for oral fluency, depending on level, and .69-.85 for comprehension, again depending on level. These estimates provide an indication of how consistently the indicators for each construct, (for example, expression, phrasing, rate, and accuracy as oral reading indictors) measure the construct of interest. The DRA2 reports strong test-retest reliability, with r=.99 for comprehension and r=.97 for oral fluency. Finally, interrater agreement estimates provided by the publisher (Gwet's Kappa coefficient) are .57 for fluency and .65 for comprehension, indicating moderate agreement between test administrators.

Validity

Reliability is a prerequisite psychometric property of any test, with validity closely following. Validity refers to the degree to which evidence gathered from an assessment supports the interpretation of the tests scores for the purposes they will be used for. (AERA, APA, & NCME, 2014). Valid decisions using test results are supported by understanding evidence of the test content, which means clear evidence that a theoretical domain is represented in the tasks of the test. Previous sections of this chapter described the ways in which developmental reading theories are represented in early reading screening measures. Two additional sources of validity evidence include evidence based on relations to other variables of similar constructs, and evidence based on consequences of interpreting test results. For the former, validity of an instrument in relation to other variables is demonstrated through alignment between the assessment and variables of interest, and evidence of correlations between the measure and an established criterion, either concurrently or at a later time (Christ & Nelson, 2014). For screening measures, this is reported in predictive validity studies, where performance at one period

of time is related to performance on an outcome variable at a later time. Inferences from predictive validity evidence support decisions regarding whether current performance levels are indicative of later achievement.

Evidence of the validity of the Aimsweb tests in relation to other variables is reported via correlations between subtests and several concurrent and future criterions, with moderate relationships between most subtests and performance on the criterion measure. Strong correlations are reported between R-CBM and criterion measures administered concurrently. The DRA2 reports moderate to strong concurrent validity correlations, and for predictive validity on measures administered 5 months later, moderate coefficients for fluency, and stronger coefficients for comprehension, albeit with a small sample of 31 students. The validity evidence reported in the Aimsweb (Pearson, 2012c) and DRA2 (Pearson, 2011c) technical manuals is presented in Table 2.

Because screening measures are used to identify which students may be at-risk for later reading problems, validity analyses for a screener must also test whether the assessment results accurately identify which students are at-risk and which are not.

Classification Accuracy

While validity is traditionally reported in terms of correlation coefficients as described in the preceding paragraph, recently, more contemporary understandings of validation have been put forth. Kane (2013) for example, argued that "to validate an interpretation or use of test scores is to evaluate the plausibility of the claims based on the test scores" (p. 1). In order to validate a given assessment, the interpretations, uses, and consequences of test scores must be carefully considered, and it is those interpretations and uses that are validated, rather than the test itself.

As seen in the example of CBM, it has become common for schools to use one test for multiple purposes (AERA, APA & NCME, 2014). It is important that tests used in this way be validated for these multiple purposes, which may require different types of technical evidence. When a test is used for the purpose of screening, it is crucial that it be able to accurately classify students according to whether they are at risk for later reading problems. Classification accuracy is typically reported in terms of *sensitivity* and *specificity* (VanDerHeyden, 2011). *Sensitivity* refers to the proportion of true positives, or those students who failed to pass the criterion measure and who were identified by the screener, while *specificity* refers to the true negatives, or students who attained proficiency on the criterion and who were not identified by the screener. High false negative rates (1-sensitivity) are considered most problematic, as students in need of intervention are not identified (Ritchey & Speece, 2004; Jenkins et al., 2007). However, high false positive rates are also undesirable, as this leads to wasted resources when students not in need of intervention are misidentified (Hintze, Ryan & Stoner, 2003). Two other indices, *positive predictive value* (PPV) and *negative predictive value* (NPV) are indicators of the proportion of students who were identified as at risk who were truly at risk on the later criterion, and the proportion of students who were identified as not at risk who were truly not at risk on the later criterion. Glover and Albers (2007) suggest that PPV and sensitivity are the most important of these four indices in determining the technical adequacy of a screening tool, because accurately identifying which students need additional instructional support is the primary purpose for screening in schools. They also note that an overall *hit rate,* or proportion of all students that are correctly classified*,* is commonly reported yet difficult to interpret depending on the prevalence of

reading failure in the sample. These indices for measuring classification accuracy are presented visually in Figure 1. Based on their review of research related to early childhood screening, Glover and Albers (2007) question the utility of measures with sensitivity, specificity, and PPV of less than 75 or 80%. It has been recommended elsewhere that false negatives be minimized by aiming for a sensitivity rate of .90 (Compton et al., 2006; Jenkins et al., 2007). More moderate values, such as minimum sensitivity of .80 and specificity of .70 are acceptable according to other authors (Klingbeil, et al., 2015). Acceptable values vary depending on the screening approach. If universal screening at benchmark periods is used to identify students for intervention, as is common practice in schools (Fuchs, Fuchs & Compton, 2012), screening measures should be highly accurate according to all indices. However, screening practices that allow for multiple stages of follow up screening might allow more false positives in the initial screening period (VanDerHeyden, 2011).

The use of receiver operating characteristics (ROC) curves (Swets, 1996) is common in deriving cut scores that balance sensitivity and specificity. These curves plot the sensitivity against the false positive rate (1-specificitiy) for each possible cut point. ROC analysis also provides the area under the curve (AUC), a statistic useful in evaluating the overall accuracy of a diagnostic test with an AUC greater than .90 indicating excellent classification; .80 to .90, good; .70 to .80, fair; and below .70, poor classification (Compton et al., 2006).

Classification Accuracy of CBM

There is ample research to support the use of R-CBM in predicting performance on high stakes state tests, especially when the screener and outcome measure are given in

the same year. Stage & Jacobsen (2001) for example, found a relationship between slope in R-CBM and performance on the Washington state assessment among fourth grade students. R-CBM performance in the fall of fourth grade was able to accurately predict performance on the state assessment for 74% of participants. Several other studies have found fall R-CBM scores in grades three and above to be significant predictors of end of year performance in high stakes tests in various states. (Shaw & Shaw, 2002; Ball & O'Connor, 2016; McGlinchey & Hixon, 2004). Relatively fewer studies have examined longer term predictive validity of R-CBM. Silberglitt and Hintze (2005) examined the relationship between R-CBM administered three times a year beginning in the winter of first-grade, and the Minnesota state assessment administered at the end of third-grade. While correlations and classification accuracy increased for administrations closer to the outcome assessment, they found that even in the winter of first-grade, R-CBM accurately predicted third-grade assessment performance, with a moderate correlation of .47 between measures. Using logistic regression and ROC curve analysis, the authors were able to work backwards to establish the most sensitive cut scores for each benchmarking period in order to improve the utility of R-CBM as a screener with the specific population of participants in their study. Using the spring of first-grade benchmarking period, they were able to attain a sensitivity of .75 and specificity of .71 when predicting third-grade reading assessment performance. This same procedure for working backwards from a criterion test to validate a screening tool and establish the most sensitive cut points has been recommended to researchers, as well as school districts wanting to identify the students most likely to benefit from intervention (Jenkins et al., 2007). While this type of research has validated the use of R-CBM to predict same year outcomes, there is less

evidence of the utility of R-CBM and other measures (such as LNF, PSF and NWF) for predicting longer term outcomes for first-graders. Available evidence is reported in Table 3 and reviewed in the following paragraphs.

Good et al. (2001) investigated the utility of individual DIBELS subtests to predict performance at the subsequent benchmark period and used this information to derive benchmark goals. For example, 90% of students who reached the winter first-grade NWF benchmark goal reached the spring first-grade R-CBM benchmark goal, 97% of students who reached that goal met the second grade R-CBM goal, and 96% of students who reached that goal passed the Oregon state assessment in third-grade. Johnson et al. (2009) examined the classification accuracy of DIBELS measures administered in the fall of first-grade when predicting end of first-grade performance below the 40th percentile on the Stanford Achievement Test – 10th Edition (SAT-10). Holding sensitivity at 90%, they found specificity levels of .20 for PSF, .42 for NWF and interestingly, .59 for ORF which is not typically administered in the fall. Goffreda, Diperna & Pedersen (2009) investigated longer term prediction, looking at the relationship between first-grade early CBM measures (including LNF, PSF, NWF and R-CBM), and the Pennsylvania third-grade outcome measure. They found that R-CBM was the only significant predictor in a logistic regression model, and the only measure that demonstrated adequate levels of sensitivity and specificity. In this study, sensitivity for LNF administered in the winter of first-grade was .47, while specificity was .70. Sensitivity for PSF was .77, while specificity was .47. Sensitivity for NWF was .89, while specificity was .50. Sensitivity for R-CBM was .77, and specificity was .88. The authors used ROC curves to establish optimal cut points to balance sensitivity and

specificity for the specific population of participants, yet still did not reach adequate levels, with the exception of R-CBM.

Catts, Petscher, Schatschneider, Bridges and Mendoza (2009) examined DIBELS measures for floor effects, and investigated the consequences of these effects on the predictive validity of subtests administered in kindergarten through third-grade. ORF was used as an outcome measure for PSF and NWF, while the SAT-10 was used as an outcome measure for ORF administrations. Initial administrations of each DIBELS measure were marked by strong floor effects, meaning that many children score near the lower end of the distribution. Predictive validity for each measure improved across administrations, with the exception of PSF which became less predictive over time. This has implications for universal screening, demonstrating the importance of choosing an optimum time point for the initial administration of each measure. Relevant to the current study, the authors suggest that based on their results, by the winter of first-grade, floor effects for LNF and NWF will have been minimized, but ORF will be subject to floor effects as it is the first administration of this measure and the ability of students to read connected text fluently is just emerging at this point in time. Based on this study, as well as those described above, PSF may not have utility as a stand-alone screening tool due to high false positive rates. Similarly, Hintze and colleagues (2003) investigated the classification accuracy of PSF, with the Comprehensive Test of Phonological Processing (CTOPP) as the criterion, and found that PSF over-identified children as having a weakness in phonological awareness.

Other studies have examined shorter term predictive validity of early literacy CBM measures. Clemens, Shapiro and Thoemmes (2011) investigated the utility of fall

DIBELS subtests, as well as another measure (Word Identification Fluency (WIF)) to predict end of year R-CBM performance above the 30th percentile. WIF was the most accurate predictor. When sensitivity was held at .90, PSF led to high rates of false positives, with specificity at .20. Specificity for LSF and NWF were .64 and .59, respectively. With a sample of over 800 students, Riedel (2007) examined the utility of DIBELS subtests in predicting later reading comprehension as measured by performance above the 40th percentile on the second grade TerraNova reading subtest. For the fall administration, LNF was the best predictor, with a sensitivity of .67 and specificity of .64. PSF resulted in a sensitivity of .58 and specificity of .58, and NWF resulted in a sensitivity of .65 and specificity of .61. Consistent with other research, in the middle of first-grade, ORF was the most accurate predictor, with a sensitivity of .69 and specificity of .65 in the winter of first-grade. Sensitivity for PSF administered at the same time was .54, with specificity .54 as well. Properties of NWF included sensitivity of .62 and specificity of .58. Based on the poor classification accuracy of PSF and NWF, the author goes as far as to recommend that only ORF be administered beginning in the middle of first-grade. While LNF, PSF and NWF have been analyzed as described in the studies above, use of the LSF measure with first-graders has not been widely investigated in terms of predictive validity.

Based on available research, it would seem that neither Aimsweb TEL measures, nor R-CBM approach the recommendations of Jenkins et al. (2007) for appropriate sensitivity and specificity when used in first-grade. The current study contributes to the existing literature by establishing cut scores that result in adequate levels of sensitivity. While higher cut scores might result in lower levels of specificity, this may be acceptable

as part of RTI practices that quickly rule out the need for further intervention with students with potential false positive results on the initial universal screening benchmark.

Classification Accuracy of IRIs

There has been relatively little investigation of the classification accuracy of IRIs. Klingbeil, et al. (2015) and Parker and colleagues (2015) examined the predictive validity and diagnostic accuracy of the Fountas & Pinnell Benchmark Assessment System (BAS; Fountas & Pinnell, 2010), an IRI comparable to the DRA2. They investigated technical properties of the BAS and R-CBM administered to second and third-graders in the fall, finding that while correlations between both predictors and the criterion were high, as were correlations between R-CBM and BAS themselves, neither measure adequately predicted performance on the Measures of Academic Progress (MAP) in the spring. However, diagnostic accuracy of R-CBM was much higher than the BAS. The authors suggest that "poorly developed criteria" may explain the low diagnostic accuracy of the IRI. These studies cast doubt regarding the utility of IRIs as screening tools for second and third-grade students, due to the fact that they take much longer to administer than R-CBM, but are worse at predicting future reading ability. Importantly, no similar study has tested the classification accuracy when using an IRI with a population of first-graders.

Usability

Usability refers to a screening instrument's practical characteristics when administered in a given context. The balance of cost and benefits to using the tool should be carefully examined, keeping in mind that costly screening tools refer not only to those that incur monetary expenses, but also those that detract from instructional time. Screening tools should be acceptable to multiple stakeholders, including school staff,

students, and families. Buy-in from these stakeholders is most likely to occur if they see that benefits outweigh the costs.

Administration of the screening tool should be feasible for school staff who may experience turnover from year to year. Complicated administration may result in unreliable data, or incur additional training costs. Administration guides should be able to be understood by the diverse set of adults who may administer assessments in schools, and provide enough direction, training materials and support to elicit reliable results across administrators. Schools can also evaluate the infrastructure requirements for not only administering screening tools, but also managing and interpreting data.

Usability also includes consideration of whether appropriate accommodations are available for administering the measure to specific populations such as students with disabilities or English language learners, and for scoring and interpreting results for these subgroups. Finally, effective screening tools have evidence of treatment utility, meaning that the information gathered through use of the screening tool should be useful in determining what intervention support is best to meet students' diverse instructional needs.

In terms of time costs, the Aimsweb tests consist of four one-minute probes in the fall of first-grade, and three one-minute probes in the winter, making administration time roughly 5-7 minutes per student to allow for instructions to be read to the student. Financial costs include $8 per student for an annual subscription which includes screening as well as progress monitoring, and access to the Aimsweb online data management system. This price is reduced to $4.50 per student for current members.

Training options include free webinars, and online training for $299 per person, or an onsite training for 30 staff for $3500.

The DRA2 administration time ranges from 5-60 minutes per student, depending on level, with the levels at which first-graders are typically assessed requiring 10-20 minutes of testing time per student. Financial costs include purchase of a testing kit, which can be shared between multiple teachers, for $423, and 90$ per year for a classroom subscription to the optional online management system ($4.50 per student beyond 30 students). Training options include a 90-minute training DVD included with the test kit, on demand online tutorials, and onsite professional development at an additional cost.

It would seem that the DRA2 involves more upfront cost for a classroom of students, but the kit can be used in subsequent years without making additional purchases. However, use of the online data management incurs an ongoing cost comparable to Aimsweb subscription. The time required to administer the DRA2 is significantly longer than Aimsweb, and indeed, despite their face validity among educators, the time required to administer, score and interpret IRIs has been identified as a drawback (Paris & Carpenter, 2003, Klingbeil et al., 2015**).**

Conclusion

Based on developmental reading research and theory, as well as the limited available empirical evidence on IRIs, it would seem that the DRA2 does not demonstrate appropriateness, technical adequacy, nor usability as a screening tool in the way that Glover and Albers (2007) illustrate. At the very least, educators wishing to adopt early reading screeners as part of RTI systems can consult abundant studies of CBM tools and

consider how these tools fit their need and contexts. However, such studies are not available to inform the use of IRIs for this purpose. Additional investigation that evaluates the DRA2 in the same manner as early reading CBM is warranted. The current study seeks to fill gaps in the preceding discussion of first-grade screening tools, particularly related to the use of IRIs to predict risk of later reading problems.

Table 1. Stages of Reading Development (Chall, 1996)

Stage		Approximate grade/age	Key characteristics	Supported by
0	Pre-reading	Birth- Age 6 Preschool	• Ability to retell familiar stories using illustrations • Interest in rhythm and rhyme • Recognition of some letters • Understanding of concepts of print (directionality, etc.).	• Picture books read aloud • Retelling of familiar stories • Language play (nursery rhymes, etc.) • Instruction in phonological awareness, letter names and sounds
1	Initial Reading or Decoding	Ages 6-7 Grades 1-2	• Developing knowledge of letters and sounds • Able to read decodable text and commonly used irregular words • "Glued to print" as children decode letter by letter	• Direct instruction in phonics, syllable patterns and common irregular words • Reading decodable text • More advanced books read aloud to child to develop knowledge of language structures, vocabulary, and comprehension strategies
2	Confirmation, Fluency, Ungluing from Print	Ages 7-8 Grades 2-3	• Students consolidate knowledge acquired in Stage 1 • Read simple texts with increasing fluency and speed	• Wide reading about familiar content • Analysis of multisyllabic words • Continued development of oral language and background knowledge
3	Reading for Learning the New	Ages 9-13 Grades 4-8	• Students have gained sufficient automaticity with decoding to read straightforward texts to learn new information.	• Reading text books and advanced trade books • Instruction in text structures • Development of background knowledge • Vocabulary instruction
4	Multiple Viewpoints	Ages 14—18 High School	• Students have gained the ability to compare and contrast multiple viewpoints	• Instruction in text structure, inferential thinking, specialized vocabulary • Wide reading of high quality literature and nonfiction texts
5	Construction and Reconstruction	Ages 18+ College and beyond	• Literate adults select what to read based on individual purposes. • Synthesize information gathered from texts to draw their own conclusions and develop new points of view	• Wide reading • Analysis of text structure, style, author's perspective • Written response to reading

Table 2. Concurrent and Predictive Validity Evidence Provided by Assessment Publishers

Subtest	Administration period	Criterion	Criterion administration period	n	r	Study
LNF	Fall 1st	PSSA	Spring 1st	437	.47	Aimsweb user data (Pearson, 2012c)
	Fall 1st	MCA	Spring 3rd	75	.50	
	Fall 1st	R-CBM	Spring 1st	48	.76	
LSF	Fall 1st	PSSA	Spring 1st	435	.33	Aimsweb user data (Pearson, 2012c)
PSF	Fall, Winter, Spring 1st	MCA	Spring 3rd	130-134	.41-.51	Aimsweb user data (Pearson, 2012c)
	Winter 1st	R-CBM	Spring 1st	46	.76	
NWF	Fall 1st	R-CBM	Spring 1st	46	.72	Aimsweb user data (Pearson, 2012c)
	Fall, Winter, Spring 1st	PSSA	Spring 1st	434-438	.44-.51	
	Fall, Winter, Spring 1st	MCA	Spring 3rd	130-134	.42-.53	
R-CBM	Winter 1st	PSSA	Spring 3rd	~ 200	.60	Keller-Margulis, Shapiro, & Hintze (2008)
	Winter 1st	MCA	Spring 3rd	1475	.47	Silberglitt & Hintze (2005)
	Spring 3rd	PSSA	Spring 3rd	185	.67	Shapiro, Keller, Lutz, Santoro, & Hintze. (2006)
	Spring 3rd	MCA	Spring 3rd	2126	.71	Silberglitt & Hintze (2005)
DRA2	Grades 1-3 (Comprehension score)	GORT 4	concurrent	66	.60 (comprehension) .65 (fluency)	Publisher study (Pearson, 2011c)
	Grades 1-3 (Fluency score)	GORT 4	concurrent	66	.62 (comprehension) .69 (fluency)	
	Grades 1-3 (Comprehension score)	DIBELS ORF	concurrent	66	.70	
	Grades 1-3 (Fluency score)	DIBELS ORF	concurrent	66	.74	
	Grades 1-3 (Comprehension score)	GRADE Comprehension	5 months later	31	.69	
	Grades 1-3 (fluency score)	DIBELS ORF	5 months later	31	.51	

Note: PSSA= Pennsylvania System of School Assessment; MCA= Minnesota Comprehensive Assessment; SAT-10 = Stanford Achievement Test-10th Edition.

Table 3. Classification Studies of First-Grade Screening Measures

Study, sample size	Benchmark period	Measures	Cut Score	Outcome criterion	ROC AUC	Sens.	Spec.
Goffreda, et al. (2009) n=51	Winter 1st	LNF	37	3rd Grade PSSA Reading Proficient		.47	.70
		PSF	35			.77	.47
		NWF	24			.89	.50
		R-CBM	20			.77	.88
Johnson, et al. (2009) n=12,055	Fall 1st	PSF	55*	1st grade SAT-10 score <40%	.663	.90	.20
		NWF	42*		.781	.90	.42
		R-CBM	18*		.830	.90	.59
Catts, et al. (2009) n=>17, 000	Winter 1st	PSF	*	3rd Grade Spring R-CBM	.606	.90	.22
		NWF	*		.869	.90	.51
		R-CBM	*	3rd Grade SAT-10	.784	.90	.41
Clemens et al. (2011) n=138	Fall 1st	LNF	40*	1st Grade Spring R-CBM	.849	.90	.64
		PSF	50*		.728	.90	.20
		NWF	23*		.835	.90	.59
Riedel (2007) n=>800	Fall 1st	LNF	39	2nd Grade Spring TerraNova	.700	.67	.64
		PSF	17		.620	.58	.58
		NWF	19		.680	.65	.61
	Winter 1st	PSF	32		.580	.54	.54
		NWF	34		.650	.62	.58
		R-CBM	22		.760	.69	.65
Silberglitt & Hintze (2005) n=1549	Spring 1st	R-CBM	49	3rd Grade Spring MCA		.75	.71

Note: PSSA= Pennsylvania System of School Assessment; MCA= Minnesota Comprehensive Assessment; SAT-10 = Stanford Achievement Test-10th Edition.

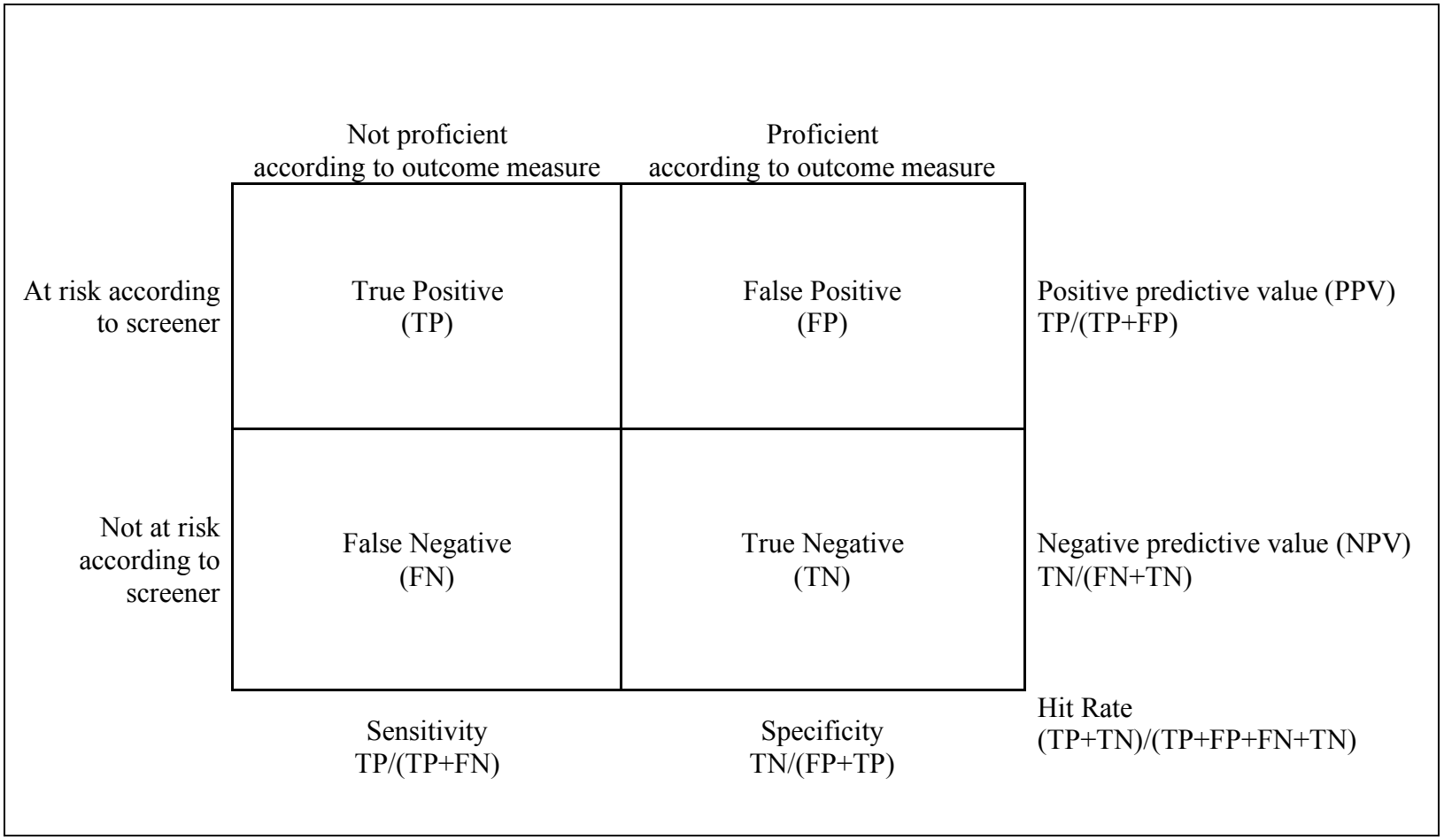


Figure 1. Classification Accuracy Indices

CHAPTER 3

METHODS

General Design

This study examines the appropriateness, usability, and technical adequacy of the DRA2 when used as a screening tool in first-grade, in comparison to Aimsweb CBM measures. In order to investigate these properties of each assessment, and to ultimately make a judgment regarding the validity of inferences made about first-grade readers based on resulting scores, a mixed method approach was employed. A recent investigation revealed that while school psychologists naturally use quantitative and qualitative data to guide decisions, mixed methods studies are underrepresented in the literature (Powell, Mihalas, Onwuegbuzie, Suldo, & Daley, 2008). The authors further contend that mixed methods designs provide richer data than monomethod approaches, thus supporting a better overall understanding of research problems. In the case of this study, while pre-existing quantitative data was analyzed to evaluate the predictive validity of screeners, it was crucial to also investigate how the school district actually uses the scores in the context of their universal screening practices.

Mixed methods research designs are typically classified based on four criteria, including 1) implementation of data collection, 2) priority given to quantitative and qualitative approaches, 3) stage at which integration of data takes place, and 4) theoretical perspective of the researcher (Creswell, Plano Clark, Gutmann, Hanson, 2003). In the current study, quantitative data had already been collected by the participating school district as part of their existing accountability practices. Qualitative data, in the form of an educator questionnaire, was collected concurrently with analysis

of quantitative data, as each type of data addressed separate questions and did not need to be analyzed in a particular order. As a study of predictive validity, it might be argued that priority was given to the quantitative data, however since a judgment about interpretation of that data cannot be made without understanding the purposes for which educators actually use it, qualitative data was also emphasized. Data integration took place only after each set of research questions was explored separately. In terms of theoretical perspective, this researcher took a deductive approach, meaning that hypotheses were developed based on existing theory and previous empirical research. The study was designed to test the validity of these hypotheses in the context of a specific setting. The first set of research questions focused on the content and format of each assessment, as well as the ways in which one school district used scores for educational decision-making. These questions were addressed through a qualitative approach. The following three research questions examined the technical adequacy of the screeners in question, and were answered through quantitative inquiry. Tashakkori & Creswell (2007) recommend that in mixed methods studies, following the qualitative and quantitative questions, a question explicitly integrating these questions be posed. Consistent with this guidance, data from both approaches were used to address the seventh research question.

Setting and Participants

Existing longitudinal reading assessment data was obtained from a suburban school district in Western Massachusetts. The data included assessment scores from 269 students from two cohorts who entered first-grade in the fall of 2013 and 2014 and completed the third-grade outcome measure in the spring of 2016 and 2017. The district included four elementary schools, all of which are represented in the sample. Within the

total sample of students, 52% of students were male. Forty-five percent (45%) of students identified as white, 21% Hispanic, 14% Asian, 9% Black and 10% Multiracial. During their kindergarten through third-grade years, 47% of students were eligible for the free or reduced-price lunch program for at least one school year, 19% of students received special education services during at least one school year, and 20% were eligible for English language learner services during at least one school year. While some students who had been identified as ELL in first-grade were no longer found eligible for ELL services in third-grade, for the purposes of analyses, these students were considered ELL. This decision was made based on the theory that children need 5-7 years, on average, to acquire the language proficiency required to complete grade level academic work in a second language (Cummins, 1979). Complete demographic characteristics by grade cohort are presented in Table 4.

The educator questionnaire was distributed to all educators within the school district who make educational decisions about first-graders based on reading assessment data. Twelve (12) teachers completed the questionnaire. Respondents included 2 classroom teachers, 3 special education teachers, 2 reading specialists, 4 reading intervention teachers, and one district-wide instructional coach.

Measures

Quantitative Measures

Aimsweb

Consistent with the screening timeline recommended by Aimsweb (Pearson, 2012a), the early literacy and R-CBM subtests were administered to students in

September, January and May of their first-grade year. The fall and winter screening data were used in the present study.

Aimsweb Reading-Curriculum Based Measurement

The Aimsweb R-CBM measure was administered in a manner consistent with other reading CBM probes. Students were required to read three standardized grade level passages aloud, with the median words read correctly per minute recorded as the score. The publisher reports winter first-grade alternate form reliability of .95, and interrater reliability of .97 for the median of three screening scores (Pearson, 2012c). Investigations of predictive validity using first-grade R-CBM and third-grade standardized tests have found correlations of .60 (Keller-Margulis, Shapiro, & Hintze, 2008), and .47 (Silberglitt & Hintze, 2005). In general, research supports the use of R-CBM as an indicator of broader reading skills (Fuchs et al., 2001) and as a screening tool (Stage & Jacobsen, 2001; Hintze & Silberglitt, 2005).

Aimsweb Letter Naming Fluency

During administration of the Aimsweb LNF measure, students were presented with a page of upper and lower-case letters and asked to name as many letters as possible in one minute. The score was the number of letters correctly named in one minute. Based on a study conducted with 75 students in the spring of kindergarten (Elliott et al., 2001), the publisher reports retest reliability, alternate-form reliability, and interscorer agreement ranging from .80-.94 (Pearson, 2012c). The correlation between a fall first-grade administration of LNF and the third-grade Minnesota state assessment was .50 (Pearson, 2012c)

Aimsweb Letter Sound Fluency

On the Aimsweb LSF measure, students were similarly presented with a page of randomly organized upper and lowercase letters, and were required to point to each letter and provide the letter sound. The resulting score was the number of sounds correctly identified in one minute. Reliability estimates are .82-.83 (Pearson, 2012c). Previous research has not investigated the predictive validity of this measure when used during the fall of first-grade. However, spring of kindergarten administrations correlated with third-grade Illinois achievement test with coefficient of .52 (Pearson, 2012c).

Aimsweb Phoneme Segmentation Fluency

The Aimsweb PSF measure requires students to say the phonemes in orally presented words for one minute, with the number of correct phonemes recorded as a score. Phonological awareness is an important readiness skill that is prerequisite to decoding, and similar PSF measures have demonstrated evidence of reliability and validity for use in educational decision-making (Kaminski & Good, 1998; Good et al., 2001). Aimsweb reports retest reliability, alternate-form reliability, and interscorer agreement ranging from .84-.87 for PSF when administered in the spring of kindergarten. Correlations between first-grade administrations of PSF and a third-grade criterion test ranged from .41-.51 (Pearson, 2012c).

Aimsweb Nonsense Word Fluency

The NWF measure requires students to say the sounds of visually presented pseudowords for one minute, with the number of correct sounds recorded as a score. This assessment captures the emerging decoding skill of young readers, and like PSF, has demonstrated utility for identifying risk and informing instruction (Good et al.,

2001). Only alternate form reliability is reported by the publisher for this measure (.74 between fall and winter administrations, .78 between winter and spring administrations). Aimsweb reports correlations of .42-.53 between NWF administered in during first-grade screening periods and a third-grade standardized test (Pearson, 2012c).

Aimsweb Composite Score

In order to create a score that encompassed all of the foundational literacy skills assessed by the Aimsweb measures, composite scores were calculated for both the fall and winter Aimsweb administrations. Composite scores were created by calculating the sum of all individual measures administered within a given benchmarking period. Although the edition of Aimsweb used in this study does not report composite scores, this calculation method is consistent with the manner in which first-grade composite scores are calculated for DIBELS Next, and Aimsweb Plus, two similar early literacy CBM packages (Dynamic Measurement Group, 2010; Pearson, 2015).

Developmental Reading Assessment-Second Edition

The DRA2 (Pearson, 2011a) is an informal reading inventory used to assess the reading proficiency of children in kindergarten through eighth grade. According to the publisher, it measures three "critical components" of reading: reading engagement, oral reading fluency, and comprehension. The assessment is administered individually; students read from and respond to a set of illustrated leveled texts ranging from level A to level 80, to determine which text is at their instructional level. Administration time ranges from 5-15 minutes for emergent readers to up to 60 minutes for extending (levels 28+) readers. A student's score on the DRA2 is his or her "independent reading level," or the level at which the student can "engage with the text independently." Thus, the DRA2

elicits categorical scores in the form of the student's reading level. The DRA2 technical manual reports high test retest reliability estimates of .97-.99 for first-grade. Overall interrater reliability is reported as .66 for fluency, and .72 for comprehension, with higher reliability between "expert" test administrators. Internal consistency reliability for oral reading fluency ranges from .54 to .85 depending on level, and from .58 to .85 for comprehension. The technical manual provides extensive evidence for face validity among teachers, and concurrent validity is reported for the Gray's Oral Reading Test-4th Edition, DIBELS ORF, and Gates MacGinitie Reading Test-4th Edition, with correlations ranging from .60 and .76 depending on grade level and criterion measure. Predictive validity between the DRA2 and the Group Reading Assessment and Diagnostic Evaluation (GRADE) administered five months later is .69 for grades one through three (comprehension), and between the DRA2 and DIBELS ORF .51 for first through third-grades (fluency) (Pearson, 2011c).

Massachusetts Comprehensive Assessment System

The outcome measure used in this study was the third-grade scaled score on the English Language Arts MCAS, Massachusetts' criterion referenced test of student achievement and school accountability for grades 3-10 (Massachusetts Department of Elementary and Secondary Education, 2015). The test is based on standards of the Massachusetts Curriculum Framework for English Language Arts and Literacy, aligned to the Common Core State Standards. The MCAS is an untimed, group administered test comprised of reading passages followed by multiple choice and short open response items. It is administered in two sessions in early March. Beginning with the spring 2017 administration of the Massachusetts state achievement test, the "Next Generation" MCAS

was introduced, replacing the nearly 20-year-old "Legacy" MCAS. According to the Massachusetts Department of Elementary and Secondary Education, the new test "focuses on students' critical thinking abilities, application of knowledge, and ability to make connections between reading and writing" (Massachusetts Department of Elementary and Secondary Education, 2017b). The new assessment was reported to be generally "more rigorous" than its predecessor in terms of expectations for proficiency.

In the present study, student Cohort 1 was assessed with the Legacy MCAS in the spring of 2016. Student scores on this measure are reported according to four achievement levels: *Advanced*, *Proficient*, *Needs Improvement*, and *Warning*. Student Cohort 2 was assessed with the Next Generation MCAS in the spring of 2017. Achievement levels for the new assessment are as follows: *Not Meeting Expectations*, *Partially Meeting Expectations*, *Meeting Expectations*, and *Exceeding Expectations*. For the purposes of analyses in this study, student performance at the higher two levels of each assessment was considered to be a passing score.

Qualitative Data Collection

Content Analysis

The content and format of each first-grade assessment tool were analyzed in order to understand the constructs purportedly measured by each tool, as well as details of administration and technical evidence. Content analysis refers to, "a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use" (Krippendorff, 2013, p. 24). In a directed approach to content analysis (Hsieh & Shannon, 2005), categories that informed the analyses are derived primarily from existing theory and research, rather than from the texts themselves. In this

case, the Glover and Albers (2007) heuristic was used to classify the characteristics of effective screening tools. Documents examined included student materials, test administrator instructions for each measure, and relevant portions of the technical manual for each assessment.

Educator Questionnaire

Qualitative data collection practices emphasize collecting data from a relatively small number of participants who are closely connected with the research questions. In this study, a mixed questionnaire was employed to gather input from first-grade educators who use the reading assessment data being investigated to make educational decisions about their students. A mixed questionnaire is a self-report data collection instrument that includes a combination of closed-ended and open-ended items (Johnson & Turner, 2003). Development of the questionnaire was again guided by the recommendations of Glover and Albers (2007), as well as the questions put forth by Coyne and Harn (2006) in their discussion of data-based decision-making across the four distinct purposes of assessment. Using a Likert scale, participants indicated the degree to which they agreed with statements derived from each of these sources. Open ended comment boxes were made available for teachers who wished to elaborate on their responses and provide additional qualitative information. Additional open-ended questions were employed to investigate teachers' perceived purposes for each assessment. The questionnaire was created and distributed online using Qualtrics (https://www.qualtrics.com). Before dissemination to study participants, the questionnaire was piloted with first-grade teachers not in the participating district, as well as school psychology graduate students who were familiar with early reading instruction and assessment. Revisions were made to improve the

clarity of questions and minimize response time for participants. The educator questionnaire is presented in Appendix C.

Procedures

The content analyses were conducted by the primary investigator. After examination of the test materials, administrator guidelines, and the technical manuals for each assessment, evidence related to the pre-determined categories was examined to facilitate a side by side comparison of each tool.

After being piloted, the final questionnaire was disseminated to each of the four elementary school principals in the participating district, with a request that principals forward the recruitment email to any teacher involved in decisions related to first-grade reading assessments, including first-grade classroom teachers, reading specialists, special educators, and administrators. The questionnaire was available to teachers for two weeks. Twelve (12) responses were obtained.

The database of student-level screening data used for the quantitative analyses in this study was collected by the participating school district as part of their annual assessment plan. Each of the Aimsweb measures were individually administered to first-graders by building-based reading intervention staff according to screening timelines recommended by the publisher (Pearson, 2012a), with three annual benchmarking periods occurring in September, January, and May. The DRA2 was administered to all first-graders in the fall and winter by their classroom teachers. The MCAS was group administered to third-graders in March, according to state guidelines. Scores on each of the measures were provided to the researcher in spreadsheet form. Because the data was collected by the school, precise information regarding assessment integrity is not

available. However, the data represents information that is typical of school practice and thus reflects data used to make educational decisions.

Before sharing the reading assessment data with the researcher, district information technologies (IT) staff created a unique identifying number for each student and removed all names and local and state ID numbers. Data from individual spreadsheets obtained from the school district was merged using unique identifying numbers. Due to normal attrition, some observations were missing either the first-grade predictor results, or the third-grade outcome results. Listwise deletion was used to eliminate cases for which no score was available on the outcome measure. Cases were retained if at least one score among the predictor variables was available.

Data Analysis

The first three research questions were addressed through content review of the test materials, and the educator questionnaire. Evidence of each set of test materials' alignment to the criteria for appropriateness, technical adequacy, and usability was reviewed in the previous chapter. The questionnaire provided further data regarding teachers' perceptions of how each assessment meets these criteria, as well as data related to teachers' perception of the purpose of each assessment. Two sample t-tests were conducted to determine whether teachers' differential agreement with statements about IRIs and early literacy were significant in this small sample, and open ended responses were examined as well. Data from the content review and questionnaire were synthesized to address research questions related to appropriateness of intended use and usability.

All quantitative analyses were conducted using Stata 15 statistical software. Before beginning the analyses, descriptive statistics for each of the reading assessment

variables were generated, and correlations between them examined. To answer the fourth research question, after testing for satisfaction of assumptions, simple linear regression analyses were used to examine the amount of variance in third-grade MCAS scores accounted for by each predictor. Because the MCAS scale, as well as proficiency standards changed in 2017, regression analyses were conducted separately for each cohort.

To answer the fifth research question related to classification accuracy, MCAS scores were dichotomized into a pass/fail variable, and logistic regression was conducted using publisher cutpoints for risk in order to obtain information about the sensitivity, specificity, PPV, NPV, and overall classification accuracy of each screening tool using recommended cut points for risk. Based on the Aimsweb default cutscores, students were considered to be at risk if their fall of first-grade LNF scores were <40, LSF scores were <25, PSF scores were <35 and NWF scores were <27. For the winter first-grade benchmarking period, students were considered at risk if Aimsweb R-CBM scores were <30, PSF scores were <45, and NWF scores were <45 (Pearson, 2011b). Students were considered to be at risk if their fall first-grade DRA2 level was < 3, and if mid first-grade DRA2 level was <8 (Pearson, 2011a). Further, receiver operating characteristics (ROC) curves (Swets, 1996) were generated, plotting the sensitivity against the false positive rate (1-specificitiy) for each possible cut point. ROC analysis provides the area under the curve (AUC), a statistic useful in evaluating the overall accuracy of a diagnostic test with an AUC greater than .90 indicating excellent classification; .80 to .90, good; .70 to .80, fair; and below .70, poor classification (Compton et al., 2006). Because Aimsweb does not recommend cut points for composite scores, they were not considered in this analysis,

although AUC values for the composite scores were calculated based on overall classification.

Again, the cut score analyses were conducted separately for each cohort because of the variation in the MCAS test between administration years. However, in order to examine classification accuracy of first-grade measures using the entire sample of participants, a final classification analysis was conducted using third-grade R-CBM as an outcome. While the Aimsweb spring third-grade R-CBM cut score is 119, this cut score was not the most sensitive predictor of MCAS proficiency for either cohort. A cut score of 131 resulted in the most accurate prediction of an MCAS passing score across cohorts, with overall correct classification of 76.4%, sensitivity of 84.0%, and specificity of 68.2%. Therefore, for this analysis, a third-grade R-CBM score of less than 131 was used as an indicator of reading failure.

Next, to ascertain more sensitive first-grade screening cut scores for this population of participants, ROC coordinates obtained in the previous analyses were used to identify the cut scores for each individual first-grade measure that correspond with a sensitivity of 1) at least .80, and 2) at least .90. The resulting conditional probabilities were recalculated using the new cut scores.

To address the sixth research question related to classification accuracy for specific subgroups, logistic regression and ROC curves were again employed to calculate the sensitivity, specificity, and AUC for ELL students and FRL students. Differences between these statistics and those for non-group members were tested for significance.

Results of the analyses described above are reported in the following chapter. In Chapter 5, implications of these results are discussed, and data from all sources are

integrated to explore the final broad research question, with the qualitative inquiry providing a context for understanding the student assessment data as it is used in one school district.

Table 4. Demographic Information

Group	Cohort 1	Cohort 2
n	135	134
Male	56.3%	47.0%
Female	43.7%	53.0%
American Indian or Alaska Native	0.7%	0.8%
Asian	14.8%	12.7%
Black	14.1%	4.5%
Hispanic	17.8%	23.9%
Multiracial	9.6%	10.5%
White	43.0%	47.8%
ELL	17.0%	22.3%
Not ELL	83.0%	77.6%
IEP	23.0%	15.7%
No IEP	77.0%	84.3%
Free Reduced Lunch Eligible	49.6%	44.8%
Not Eligible	50.3%	55.2%

CHAPTER 4

RESULTS

The purpose of this study was to investigate the appropriateness, technical adequacy, and usability of the DRA2 in relation to the Aimsweb TEL. Both assessments are frequently used for various purposes in first-grade classrooms, and are commonly used as screening tools to inform the need for targeted or intensive intervention for specific students at risk of later reading difficulties.

Appropriateness for Intended Use and Usability

As a first step, the content of each measure was examined for evidence of usability and appropriateness, especially in terms of relevant constructs aligned with first-grade skills predictive of later reading success. Discussion of this evidence was presented previously in Chapter 2.

The research questions related to appropriateness and usability were also addressed through an educator questionnaire (Appendix C). A group of twelve teachers, comprised of two classroom teachers, three special educators, six reading specialists or reading intervention teachers, and one instructional coach completed the survey. Respondents had an average of 19.5 years of teaching experience, and an average of 9.75 years working in the participating school district. One hundred percent (100%) of respondents had personally administered IRIs to first-graders, while 82% had administered early literacy CBM. First, participants were asked what source of information they rely on to determine which students are at-risk for reading failure. Seventy five percent of respondents said they *very much* rely on their own professional judgement, with 25% of respondents saying they do so to a lesser degree, endorsing

somewhat on the survey. Participants' average endorsement of IRIs and the TEL was the same (2.5) with one person saying they only *slightly* use the results of IRIs, and the respondents all positively endorsing the use of the CBM measures with 50% saying they *very much* rely on them and 50% saying they *somewhat* rely on them. These teachers of first-graders endorsed the oral reading fluency measure to a lesser degree with only 16% saying they rely on them *very much*. The least relied upon measures for determining later risk were the assessments from specific reading curricula.

Respondents were then asked to identify the information they perceived was provided by both IRIs and early literacy CBM measures. In response to open ended questions, teachers indicated that IRIs were primarily used to inform diagnostic decisions, as evidenced by responses related to determining instructional reading level and analysis of reading behaviors to determine next steps for instruction. Some teachers also shared responses consistent with the purposes of screening, progress monitoring, and measuring student outcomes. However, when asked to indicate agreement to more specific statements regarding IRIs alignment with each purpose of assessment, screening was the most subscribed to purpose, followed by progress monitoring, measuring student outcomes, and last, diagnosis for instructional planning.

For early literacy CBM, open ended comments indicated that teachers use results for screening purposes in addition to diagnostic purposes, and many respondents suggested that beyond their own classrooms, the school and or district used results for screening decisions and to measure student outcomes. Similar to the results observed with IRIs, when asked to indicate agreement with each purpose of assessment based on more specific survey statements, screening was the most subscribed to purpose, with

diagnosis the least. Examination of the specific survey statements derived from Coyne and Harn's (2006) questions related to the four distinct purposes of assessment, revealed that there were no statistical differences between how the two assessments were endorsed for each assessment purpose.

In addition to the questions about how teachers use the first-grade reading assessments to make decisions, participants were also asked to indicate their agreement with several statements about the adequacy of each test aligned to Glover and Albers (2007) considerations for universal screeners (Table 5). In general, respondents rated IRIs and CBM similarly when presented with the six statements regarding whether the tests are appropriate for their intended uses, although some interesting differences emerged when the results were considered qualitatively. Teachers were slightly more likely to endorse CBM measures for being administered with appropriate timing and frequency, having research supporting their use, and measuring relevant skills predictive of later success, although there were no statistical differences in these response rates.

In terms of technical adequacy, although more teachers rated the CBM measures as more reliable across forms, time and raters than they did for IRIs, only their rating for reliability across raters was significantly different ($p = .024$). The teachers rated both measures as accurately identifying the students who are at-risk, however they were significantly more likely to say that the CBM assessments falsely identified students as at-risk when in fact they were not ($p = .008$).

No statistical differences were observed in participants' usability ratings between the two assessments. However, qualitative examination of the responses suggests that teachers endorsed the IRIs as slightly more usable than they did the CBM measures.

More respondents said that teachers, parents and students are more likely to appreciate the benefits of the IRI results than the CBM results. They were also more likely to say that IRIs are helpful for guiding instruction and result in better early literacy outcomes than do the CBM measures. However, respondents indicated that there were more resources available to administer, manage, and interpret the CBM measures.

With respect to the characteristics of appropriateness, technical adequacy and usability, some interesting correlations were observed in this small sample (see Table 5). It is notable that all significant correlations were negative relationships, meaning that those who agreed or strongly agreed with a statement for one assessment, tended to disagree with the same statement for the other assessment. This was observed when respondents were asked whether the constructs measured by each tool were relevant and predictive, with those rating IRIs as strong on this criteria rating early literacy CBM as weak, and vice versa. Additionally, participants who indicated that there were not enough resources allocated to one assessment were significant more likely to say there were enough for the other assessment. These results provide evidence that teachers may have a preferred first grade reading assessment type based on the theoretical perspective on reading development that they bring to the classroom, favoring the use of one type of data over another when making screening decisions. However, it was notable that overall, respondents were more likely to rely on their professional judgement than the results of either IRIs or CBM, especially during the winter benchmark period. Complete results of the educator questionnaire are presented in Appendix D.

Predictive Validity and Classification Accuracy

The second set of research questions dealt with the technical adequacy of each screening measure based on existing data from the participating school district. Descriptive statistics for each cohort of students are presented in Tables 6 and 7. In the entire sample, 48.1% of students did not meet standards for proficiency on the MCAS, meaning that according to this measure, the base rate for reading failure in the overall sample was 48.1%. Approximately forty seven percent (46.7%) of students in Cohort 1 failed the MCAS, and 49.6% of students in Cohort 2 failed the MCAS. Most variables were not normally distributed. According to the Stata test of skewness and kurtosis, which is based on the test as described by D'Agostino, Belanger, and D'Agostino (1990), only the fall LNF, winter PSF, and MCAS scores for both cohorts were normally distributed. Histograms of all variables are presented in Appendix E.

Correlations and Predictive Validity

Tables 8 and 9 display the correlations of each predictor variable and third-grade outcomes. For Cohort 1, all correlations were significant at the .05 level, with the exception of the winter PSF measure, which was not significantly correlated with fall LNF, LSF, NWF or DRA2 or winter R-CBM. Likewise, for Cohort 2, all correlations were significant, with the exception of the winter PSF measure, which was not significantly correlated with fall or winter NWF, or fall or winter DRA2. With the exception of the winter PSF measure, correlations between predictor variables and outcomes ranged from moderate to strong (r=.40 to r=.88). Unsurprisingly, the magnitude of correlations was strongest between the Aimsweb composite scores and their components, namely NWF in the fall, and NWF and R-CBM in the winter. DRA2 and R-

CBM administered concurrently were strongly correlated (r=.82 for Cohort 1 and r=.88 for Cohort 2) These predictors, as well as the winter Aimsweb composite were also those most highly correlated with the third-grade outcomes. Scatterplots (see Appendix F) were generated and visually examined for linearity.

Simple linear regression analyses were used to examine the amount of variance in MCAS scaled scores accounted for by each predictor (Tables 10 and 11). For each cohort, each of the first-grade measures was a significant predictor of third-grade MCAS scores, yet differences emerged between the two cohorts. The first-grade predictors accounted for more variance in third-grade MCAS scores in Cohort 1 than in Cohort 2. For Cohort 1, the fall Aimsweb composite accounted for 42% of the variance in third-grade MCAS scores, whereas the fall DRA2 only accounted for 30% of the variance. This is evidence that the constructs measured in the TEL assessments may be more predictive of later reading achievement than those measured in the DRA2 during the fall of first-grade. However, by winter, the Aimsweb composite and the DRA2 accounted for similar variance in the third-grade MCAS score, .42 and .43 respectively. These relationships were greater in magnitude but similar to the .38 of the variance accounted for in the Third-Grade MCAS by the first-grade winter R-CBM scores. The results might suggest that the fall Aimsweb measures were more predictive of later reading achievement than the fall DRA2, and that the measures are equally predictive at the developmental timepoint of the winter benchmarking period. However, these same results were not observed for Cohort 2.

For Cohort 2, the Aimsweb composite and DRA2 scores that were gathered in the fall accounted for only 24% and 22% of third-grade MCAS variance, respectively.

Therefore, both fall measures had similar predictive relationships. Although the magnitude of the relationships were not as large as observed with Cohort 1, the R^2 values from the winter scores of Cohort 2 were greater in magnitude from the fall data, and converged similarly, where R^2 was .30 for both R-CBM the Aimsweb Composite, and .29 for the DRA2.

Classification Accuracy

Classification Accuracy for Predicting Third-Grade MCAS

Classification accuracy statistics for each predictor, using MCAS proficiency as the outcome, are presented in Table 12 and Table 13. Based on the criteria suggested by Compton et al. (2006), where an AUC of .90 would indicate excellent classification and less than .70 would indicate poor classification, AUC values for Cohort 1 ranged from poor (fall and winter PSF), to good (fall NWF, Aimsweb Composite and DRA2, winter R-CBM, Aimsweb Composite and DRA2).

For Cohort 1, the fall and winter DRA2 scores were least likely to accurately identify students likely to experience later reading difficulties, with sensitivity estimates of .32 and .48 for fall and winter respectively. Because sensitivity and specificity are inversely related, the specificity estimates were very high for the DRA2 (fall = 95% accurate and winter = 93% accurate) indicating that the DRA2 accurately identifies which students are on track for reading success.

In contrast, fall LSF and winter PSF were more apt to identify students likely to struggle, with 83% accurately identified using LSF and 80% identified using PSF. However, PSF was more likely to identify students as poor readers who were not, with specificity levels ranging from lows of .35 and .30 for fall and winter PSF. Winter R-

CBM scores resulted in the highest overall levels of both sensitivity and specificity, with approximately 72% of struggling readers and 80% of strong readers accurately identified.

In general, AUC values for Cohort 2 were lower, with fall LNF, fall DRA2, fall Aimsweb composite, winter R-CBM, winter Aimsweb composite and winter DRA2 attaining only fair levels of classification accuracy. No predictors reached .80 AUC for Cohort 2. As with the AUC statistic, sensitivity and specificity levels, and in turn overall prediction, were generally lower for Cohort 2 than Cohort 1, yet general trends were consistent. Namely, PSF resulted in higher sensitivity but lower specificity, while DRA2 sacrificed sensitivity for high levels of specificity. No predictor reached the .90 sensitivity level recommended for informing high stakes decisions.

Classification Accuracy for Predicting Third-Grade Oral Reading Rate

Cohorts 1 and 2 were combined for the subsequent analyses, in which third-grade spring R-CBM scores were used as the outcome measure. Rather than use the Aimsweb spring third-grade default cut score of 119, further analysis was conducted to determine the cut score with the highest overall classification accuracy when predicting proficiency on the MCAS for both cohorts, which was determined to be a score of 131 words read correctly. This score on the Spring R-CBM measure correctly classified 76.4% of students with respect to MCAS proficiency.

Using the first-grade screening data to predict third-grade oral reading fluency above 131 WCPM, the AUC values were "good" for fall LNF (.805), the fall Aimsweb composite score (.807), winter R-CBM (.848), winter composite score (.840) and winter DRA2 (.815). AUC values were in the "fair" range for fall LSF (.734), fall NWF (.786), fall DRA2 (.776) and winter NWF (.779). AUC values were "poor" for both the fall and

winter administrations of the PSF measure. It is notable that for the ROC curve analysis, the use of an Aimsweb composite score to predict third-grade R-CBM scores did not result in AUC values that were better than those generated based on their most predictive component subtests.

Similarly to when MCAS was used as the outcome, PSF resulted in low levels of specificity (39.6% for fall, and 37.5% for winter). Overall correct classification of later reading risk using PSF as a screener was only slightly above chance in both the fall and winter. The highest overall classification accuracy was demonstrated by LNF in the fall (sensitivity = 67%, specificity = 84.6%), and by R-CBM in the winter (sensitivity = 75.0%, specificity = 78.6%), with each measure correctly classifying 77.1% of students. The winter DRA2 also resulted in high overall classification accuracy, correctly classifying 74.4% of students, yet sensitivity (50%) was compromised at the expense of specificity (92.4%), indicating students who were at-risk for later reading problems had a 50% chance of being accurately identified using the DRA2. The fall DRA2 resulted in even an even lower level of sensitivity (35.8%). Complete results of this analysis are presented in Table 14.

Using the spring of third-grade R-CBM threshold of 131 words per minute as an outcome, ROC curves were used to obtain alternative cut scores for the overall sample. The sensitivity and specificity of publisher recommended cut scores, along with alternative cut scores resulting in 1) greater than 80% sensitivity and 2) greater than 90% sensitivity are reported in Table 15. For all predictor variables, cut scores needed to be increased, sometimes dramatically, in order to achieve acceptable levels of sensitivity.

However, in doing so, specificity was compromised and, in most cases, overall classification accuracy was reduced by increasing the cut scores.

Classification Accuracy for Subgroups

To examine the differential predictive validity of the first-grade screening tools with respect to ELL and FRL subgroups, as a first step, means and standard deviations for each measure were disaggregated according to subgroups. This information is presented in Table 16. Two sample t-tests were conducted to compare the means for each measure between members and non-members of the ELL and FRL subgroups. The Aimsweb composite scores were not included in these analyses, as recommended cutscores were not provided by the publisher. Students in both subgroups performed significantly worse than their peer group with the exception of ELL students on the winter NWF measure (p=.09). Among ELL students, 81.1% failed MCAS (73.9% in Cohort 1and 86.7% in Cohort 2). Among students receiving FRL, 71.4% did not reach proficiency according to MCAS (64.2% in Cohort 1 and 79.7% in Cohort 2).

Publisher recommended cut scores for each predictor variable were used to predict third-grade R-CBM scores of 131 or greater, consistent with the previous analyses. Results of these analyses are presented in Table 17 for ELL students and Table 18 for FRL students. The AUC, sensitivity, specificity, PPV and NPV between subgroup members and nonmembers were then compared using a two proportions test.

For the ELL subgroup, while the differences between AUC and overall classification accuracy were not significantly different from those of non-ELL students, significant differences in sensitivity were observed for fall LNF, fall PSF, and fall and winter DRA2, with these measures leading to higher sensitivity among the ELL

population than among the non-ELL population. Therefore, ELL students who were at later risk for reading problems were more accurately identified using these measures than non-ELL students. Still, using the fall DRA2 only 56% of ELL students who failed to meet a proficient reading rate were identified (in comparison, only 25% of at risk English speaking students were identified). Specificity was also significantly different for fall LNF, fall LSF, fall and winter PSF, and fall and winter DRA2. Specificity was lower for the ELL group. With the exception of the DRA2 (both fall and winter administrations), PPV was higher for ELL students than proficient English speakers, and for all predictors NPV was lower for ELL students.

Overall correct classification was significantly lower for the FRL subgroup, than for the non FRL group for fall LNF and fall and winter DRA2, and significantly higher than the non FRL group for fall PSF. Again, more differences between the predictive validity of each measure for different subgroups was observed upon closer examination of sensitivity and specificity. Sensitivity was significantly higher for FRL students when fall LSF, PSF and NWF, and fall and winter DRA2 were used as predictors for third-grade R-CBM. Specificity was lower for FRL students for all predictors, with the exception of R-CBM (p=.06). Similar to the ELL subgroup, for almost all predictors PPV was higher for FRL students (winter DRA2 excluded with p=.09), and NPV was lower for all predictors.

As will be discussed further in Chapter 5, these results suggest that the predictive validity of the Aimsweb TEL and the DRA2 are not consistent across subgroups. In many cases, cut scores would need to be lowered for ELL and FRL students in order to achieve comparable levels of sensitivity and minimize false negatives. As will be discussed

further in the following chapter, teams using these data to make decisions related to early reading intervention allocations should consider disaggregated screening data so that members of subgroups have equal access to interventions.

This study's final research question seeks to form an overall judgement regarding the use of the DRA2 as compared to the Aimsweb TEL for the purpose of screening in first-grade tiered reading systems. In chapter 5, following discussion of findings, this broad question will be addressed.

Table 5. Paired Samples Test of Respondents' Ratings of Appropriateness, Technical Adequacy, and Usability Characteristics

		IRIs		CBM		Paired Sample Correlation		Paired t-test		
	N	*M*	*SD*	*M*	*SD*	r	p	t	df	p
Timing and frequency is appropriate	10	2.50	1.08	3.00	0.67	-0.31	0.386	-1.10	9	0.299
Constructs measured are relevant	10	2.50	1.08	2.90	0.74	-0.63	0.052	-0.77	9	0.462
Format and content have been validated by research	7	2.71	0.95	3.00	0.82	0.43	0.337	-0.80	6	0.457
Contextually and developmentally appropriate	11	2.36	1.21	2.27	1.27	0.19	0.577	0.19	10	0.852
Measures skills indicative of later reading success	11	2.55	0.93	2.73	1.01	-0.57	0.068	-0.35	10	0.733
Format and items are appropriate	11	2.55	1.04	2.45	1.13	-0.15	0.664	0.18	10	0.858
Alternate forms lead to comparable results	6	2.67	1.03	3.00	0.89	0.65	0.163	-1.00	5	0.363
Measurement is consistent over time	10	2.40	1.08	2.70	1.06	0.41	0.240	-0.82	9	0.434
Scoring consistent across scorers	10	1.70	0.95	2.80	0.42	-0.72	0.018	-2.70	9	0.024
Correctly identifies most students at risk	10	2.50	0.85	2.40	0.84	0.00	1.000	0.26	9	0.798
Does not falsely identify students not at risk	11	2.36	1.03	1.36	0.81	0.43	0.191	3.32	10	0.008
Identification outcomes relevant to service delivery	9	3.11	0.78	2.78	0.83	-0.34	0.369	0.76	8	0.471
Costs associated with the assessment are reasonable	6	2.17	0.75	2.83	1.17	-0.42	0.411	-1.00	5	0.363
Time commitment is reasonable	11	2.18	1.17	2.36	1.57	0.07	0.839	-0.32	10	0.756
School personnel are able to administer	11	2.73	0.79	2.82	1.08	0.53	0.097	-0.32	10	0.756
Teachers appreciate the benefits	9	2.56	1.24	1.89	1.27	0.52	0.149	1.63	8	0.141
Parents appreciate the benefits	8	2.13	1.13	1.50	0.93	0.48	0.229	1.67	7	0.140
Students appreciate the benefits	8	1.75	1.17	0.88	0.64	0.34	0.418	2.20	7	0.064
Resources available to collect/manage/interpret data	9	2.56	0.73	3.00	0.50	-0.69	0.040	-1.18	8	0.272
Teachers understand the implications of outcomes	11	2.45	1.04	2.64	0.92	0.40	0.224	-0.56	10	0.588
Parents understand the implications of outcomes	8	1.75	1.04	1.50	0.93	0.60	0.119	0.80	7	0.451
Outcomes guide instruction/intervention	11	3.00	0.78	2.36	1.29	-0.20	0.554	1.30	10	0.224
Improves student outcomes	9	2.56	0.88	2.22	1.39	0.29	0.443	0.71	8	0.500

Table 6. Descriptive Statistics (Cohort 1)

Variable	N	*M*	*SD*	Min	Max	Skewness	Kurtosis
Fall LNF	129	45.36	16.42	8	83	-0.19	2.74
Fall LSF	129	21.59	13.11	0	59	0.50	3.08
Fall PSF	128	26.55	12.67	0	56	-0.18	2.23
Fall NWF	128	33.18	30.12	0	173	1.78	7.07
Fall Aimsweb Composite	128	126.98	58.04	10	316	0.55	3.62
Fall DRA2	113	7.11	5.64	1	22	1.02	2.86
Winter PSF	132	34.77	14.77	4	75	0.03	2.65
Winter NWF	133	49.59	29.74	4	156	1.31	4.46
Winter R-CBM	131	50.93	44.82	2	204	1.06	3.36
Winter Aimsweb Composite	130	135.73	74.11	12	363	0.91	3.39
Winter DRA2	107	15.18	9.42	2	38	0.37	1.84
Grade 3 spring R-CBM	132	132.90	50.84	11	230	-0.47	2.76
Grade 3 MCAS	135	241.10	14.57	206	270	-0.10	2.43

Table 7. Descriptive Statistics (Cohort 2)

Variable	N	*M*	*SD*	Min	Max	Skewness	Kurtosis
Fall LNF	133	44.72	17.48	6	83	-0.20	2.43
Fall LSF	133	22.27	12.32	0	66	0.50	3.24
Fall PSF	133	27.78	14.10	0	56	-0.38	2.18
Fall NWF	132	36.55	32.24	0	173	1.85	6.47
Fall Aimsweb Composite	132	131.84	64.09	6	338	0.51	3.41
Fall DRA2	127	7.65	7.025	1	34	1.50	4.63
Winter PSF	133	41.12	13.83	0	75	-0.29	3.60
Winter NWF	133	63.89	34.98	11	212	1.65	6.79
Winter R-CBM	118	52.34	44.76	0	180	1.07	3.34
Winter Aimsweb Composite	118	159.58	81.75	15	425	1.00	4.15
Winter DRA2	103	14.85	9.043	2	38	0.49	2.32
Grade 3 spring R-CBM	133	133.6	48.46	10	249	-0.48	3.10
Grade 3 MCAS	133	501.6	22.72	441	560	-0.04	3.18

Table 8. Pairwise Correlations between First-Grade Predictors and Third-Grade Outcomes (Cohort 1)

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Fall LNF	—											
2. Fall LSF	.56*	—										
3. Fall PSF	.33*	.46*	—									
4. Fall NWF	.59*	.60*	.37*	—								
5. Fall Aimsweb Composite	.78*	.78*	.61*	.90*	—							
6. Fall DRA2	.59*	.40*	.36*	.72*	.73*	—						
7. Winter PSF	.07	.13	.48*	.02	.15	.11	—					
8. Winter NWF	.47*	.56*	.30*	.75*	.72*	.54*	.19*	—				
9. Winter R-CBM	.63*	.49*	.37*	.85*	.81*	.82*	.12	.75*	—			
10. Winter Aimsweb Composite	.59*	.56*	.45*	.83*	.83*	.74*	.35*	.90*	.93*	—		
11. Winter DRA2	.66*	.52*	.43*	.65*	.74*	.81*	.29*	.57*	.82*	.78*	—	
12. Grade 3 spring R-CBM	.62*	.50*	.44*	.62*	70*	.54*	.28*	.61*	.68*	.72*	.68*	—
13. Grade 3 MCAS	.49*	.54*	.44*	.57*	.65*	.55*	.31*	.51*	.62*	.65*	.65*	.68*

*p<.05

Table 9. Pairwise Correlations between First-Grade Predictors and Third-Grade Outcomes (Cohort 2)

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Fall LNF	—											
2. Fall LSF	.73*	—										
3. Fall PSF	.49*	.53*	—									
4. Fall NWF	.68*	.69*	.43*	—								
5. Fall Aimsweb Composite	.86*	.85*	.67*	.91*	—							
6. Fall DRA2	.66*	.54*	.42*	.75*	.75*	—						
7. Winter PSF	.28*	.21*	.38*	.13	.26*	.13	—					
8. Winter NWF	.68*	.65*	.37*	.85*	.81*	.71*	.26*	—				
9. Winter R-CBM	.74*	.65*	.48*	.84*	.84*	.86*	.15	.84*	—			
10. Winter Aimsweb Composite	.76*	.69*	.52*	.86*	.87*	.81*	.37*	.95*	.94*	—		
11. Winter DRA2	.76*	.59*	.48*	.74*	.79*	.84*	.11	.72*	.88*	.82*	—	
12. Grade 3 spring R-CBM	.68*	.50*	.42*	.53*	.63*	.53*	.33*	.59*	.62*	.65*	.60*	—
13. Grade 3 MCAS	.47*	.42*	.40*	.41*	.49*	.48*	.20*	.42*	.55*	.54*	.54*	.66*

*p<.05

Table 10. Simple Linear Regression Predicting MCAS Scaled Score for Cohort 1

	Model	*B*	*SE*	β	*t*	*p*	R^2
1	Fall LNF	.44	.07	.49	6.40	<.001	.24
	Constant	221.20	3.31		66.79	<.001	
2	Fall LSF	.60	.084	.54	7.15	<.001	.29
	Constant	228.25	2.11		108.26	<.001	
3	Fall PSF	.51	.09	.44	5.54	<.001	.20
	Constant	227.79	2.70		84.33	<.001	
4	Fall NWF	.28	.04	.57	7.86	<.001	.33
	Constant	232.09	1.58		146.9	<.001	
5	Fall Aimsweb Composite	.16	.02	.65	9.62	<.001	.42
	Constant	220.54	2.37		93.08	<.001	
6	Fall DRA2	1.40	.20	.55	6.88	<.001	.30
	Constant	231.93	1.84		125.73	<.001	
7	Winter PSF	.30	.08	.31	3.73	<.001	.10
	Constant	230.67	3.07		75.03	<.001	
8	Winter NWF	.25	.04	.51	6.78	<.001	.26
	Constant	229.04	2.10		109.11	<.001	
9	Winter R-CBM	.20	.02	.61	8.85	<.001	.38
	Constant	231.39	1.50		154.50	<.001	
10	Winter Aimsweb Composite	.12	.01	.64	9.56	<.001	.42
	Constant	224.39	2.01		111.32	<.001	
11	Winter DRA2	1.00	.11	.65	8.81	<.001	.43
	Constant	225.66	2.03		111.30	<.001	

Table 11. Simple Linear Regression Predicting MCAS Scaled Score for Cohort 2

	Model	*B*	*SE*	β	*t*	*p*	R^2
1	Fall LNF	.60	.10	.46	5.98	<.001	.21
	Constant	474.84	4.83		98.24	<.001	
2	Fall LSF	.77	.15	.42	5.27	<.001	.18
	Constant	484.60	3.72		130.06	<.001	
3	Fall PSF	.65	.13	.40	5.00	<.001	.16
	Constant	483.83	4.02		120.38	<.001	
4	Fall NWF	.28	.06	.41	5.09	<.001	.17
	Constant	491.91	2.70		182.42	<.001	
5	Fall Aimsweb Composite	.17	.03	.49	6.37	<.001	.24
	Constant	479.87	3.90		123.04	<.001	
6	Fall DRA2	1.49	.25	.47	6.01	<.001	.22
	Constant	490.39	2.57		191.02	<.001	
7	Winter PSF	.33	.14	.30	2.33	.021	.04
	Constant	488.16	6.12		79.74	<.001	
8	Winter NWF	.28	.05	.42	5.34	<.001	.18
	Constant	484.08	3.75		128.99	<.001	
9	Winter R-CBM	.28	7.03	.55	7.03	<.001	.30
	Constant	486.01	179.5		179.50	<.001	
10	Winter Aimsweb Composite	.15	.02	.54	6.94	<.001	.30
	Constant	476.54	3.88		122.96	<.001	
11	Winter DRA2	1.37	.21	.54	6.45	<.001	.29
	Constant	482.71	3.70		130.38	<.001	

Table 12. Classification Accuracy Statistics for First-Grade Screeners using Publisher Cut Scores Predicting MCAS Proficiency (Cohort 1)

	n	TP	TN	FP	FN	AUC	Sens.	Spec.	PPV	NPV	Overall correct classification
Fall LNF	129	31	54	15	29	.716	51.7	78.3	67.4	65.0	65.9
Fall LSF	129	50	39	30	10	.767	83.3	56.5	62.5	79.6	69.0
Fall PSF	128	47	24	45	12	.692	79.7	34.8	51.1	66.7	55.5
Fall NWF	128	44	46	23	15	.801	75.6	66.7	65.7	75.4	70.3
Fall Aimsweb Composite	128	_	_	_	_	.811	_	_	_	_	_
Fall DRA2	113	16	60	3	34	.811	32.0	95.2	84.2	63.8	67.3
Winter PSF	132	52	21	49	10	.633	83.9	30.0	51.5	67.7	55.3
Winter NWF	133	49	43	28	13	.760	79.0	60.6	63.6	76.8	69.2
Winter R-CBM	131	44	56	14	17	.835	72.1	80.0	75.9	76.7	76.3
Winter Aimsweb Composite	130	_	_	_	_	.838	_	_	_	_	_
Winter DRA2	107	25	51	4	27	.856	48.1	92.7	86.2	65.4	71.0

Table 13. Classification Accuracy Statistics for First-Grade Screeners using Publisher Cut Scores Predicting MCAS Proficiency (Cohort 2)

	n	TP	TN	FP	FN	AUC	Sens.	Spec.	PPV	NPV	Overall correct classification
Fall LNF	132	40	57	10	25	.740	61.5	85.1	80.0	69.5	73.5
Fall LSF	132	46	33	34	19	.667	70.8	49.3	57.7	63.5	59.9
Fall PSF	132	46	30	37	19	.667	70.8	44.8	55.4	61.2	57.6
Fall NWF	131	39	41	26	25	.671	60.9	61.2	60.0	62.1	61.1
Fall Aimsweb Composite	131	_	_	_	_	.709	_	_	_	_	_
Fall DRA2	126	19	59	5	43	.738	30.7	92.2	79.2	57.8	61.9
Winter PSF	132	43	31	36	22	.585	66.2	46.3	54.4	58.5	56.1
Winter NWF	132	25	51	16	40	.670	38.5	76.1	61.0	56.0	57.6
Winter R-CBM	117	34	44	14	25	.744	57.6	75.8	70.8	63.8	66.7
Winter Aimsweb Composite	117	_	_	_	_	.735	_	_	_	_	_
Winter DRA2	102	21	51	3	27	.740	43.8	94.4	87.5	65.4	70.6

Table 14. Classification Accuracy Statistics for First-Grade Screeners using Publisher Cut Scores Predicting Third-Grade R-CBM score of 131 WCPM (Cohorts 1 and 2)

	n	TP	TN	FP	FN	AUC	Sens.	Spec.	PPV	NPV	Overall correct classification
Fall LNF	258	73	126	23	36	.805	67.0	84.6	76.0	77.8	77.1
Fall LSF	258	89	60	69	20	.734	81.7	53.7	56.3	80.0	65.5
Fall PSF	257	82	59	90	26	.682	75.9	39.6	47.7	69.4	54.9
Fall NWF	256	78	95	54	29	.786	72.9	63.8	59.1	76.6	67.6
Fall Aimsweb Composite	256	_	_	_	_	.807	_	_	_	_	_
Fall DRA2	236	34	132	9	61	.776	35.8	93.6	79.1	68.4	70.3
Winter PSF	261	84	57	95	25	.627	77.1	37.5	46.9	69.5	54.0
Winter NWF	262	74	110	43	35	.779	67.9	71.9	63.3	75.9	70.2
Winter R-CBM	245	75	114	31	25	.848	75.0	78.6	70.8	82.0	77.1
Winter Aimsweb Composite	244	_	_	_	_	.840	_	_	_	_	_
Winter DRA2	209	44	110	9	44	.815	50.0	92.4	83.0	71.4	74.4

Table 15. Alternative Cut Scores and Resulting Sensitivity, Specificity and Overall Correct Classification when Predicting Third-Grade R-CBM score of 131 WCPM.

Cut score	Sensitivity	Specificity	Overall correct classification
Fall LNF			
40	**67.0**	**84.6**	**77.1**
49	82.6	61.7	70.5
57	90.8	40.9	62.0
Fall LSF			
25	**81.7**	**53.7**	**65.5**
34	91.7	24.8	53.1
Fall PSF			
35	**75.9**	**39.6**	**54.9**
38	84.2	32.9	54.5
42	90.7	17.5	48.2
Fall NWF			
27	**72.9**	**63.8**	**67.6**
30	80.4	59.1	68.0
39	92.5	42.3	63.3
Fall DRA2			
3	**35.8**	**93.6**	**70.3**
8	84.2	55.3	67.0
12	92.6	34.8	58.1
Winter PSF			
45	**77.1**	**37.5**	**54.0**
48	80.7	27.6	49.8
55	90.8	12.5	45.2
Winter NWF			
45	**67.9**	**71.9**	**70.2**
52	83.5	62.1	71.0
67	90.8	41.2	61.8
Winter R-CBM			
30	**75.0**	**78.6**	**77.1**
42	81.0	65.5	71.8
63	90.0	46.9	64.5
Winter DRA2			
8	**50.0**	**92.4**	**74.4**
16	83.0	59.7	69.6
24	90.9	39.5	61.35

**Bold row indicates publisher recommended cut score*

Table 16. Means and Standard Deviations of Scores Across Subgroups

		First-Grade Predictors					
		Fall			Winter		
Measure	Group	N	Mean	SD	N	Mean	SD
LNF	ELL	53	37.92	19.07	—	—	—
	non ELL	209	46.84	15.90	—	—	—
	FRL	123	39.77	17.13	—	—	—
	non FRL	139	49.70	15.37	—	—	—
LSF	ELL	53	16.83	14.60	—	—	—
	non ELL	209	23.23	11.85	—	—	—
	FRL	123	17.74	12.30	—	—	—
	non FRL	139	25.65	11.89	—	—	—
PSF	ELL	53	18.25	13.00	51	30.51	13.96
	non ELL	208	29.46	12.56	214	39.73	14.25
	FRL	122	22.39	13.43	124	35.24	15.93
	non FRL	139	31.39	11.94	141	40.34	12.97
NWF	ELL	53	22.98	24.85	51	49.71	28.56
	non ELL	207	37.94	31.97	215	58.41	34.04
	FRL	121	22.61	19.58	124	45.15	21.76
	non FRL	139	45.58	35.30	142	66.86	37.89
R-CBM	ELL	—	—	—	51	32.96	32.65
	non ELL	—	—	—	198	56.40	46.18
	FRL	—	—	—	120	33.48	30.87
	non FRL	—	—	—	129	68.45	48.92
DRA2	ELL	50	4.20	3.77	44	10.55	8.71
	non ELL	190	8.24	6.69	166	16.20	9.00
	FRL	111	4.77	4.08	97	11.13	8.10
	non FRL	129	9.66	7.15	113	18.35	8.83
		Third-Grade Outcomes					
			R-CBM			MCAS (z score)	
	ELL	52	108.92	43.80	53	-.68	.87
	non ELL	213	139.20	49.17	215	.17	.96
	FRL	125	112.32	47.80	126	-.50	.88
	non FRL	140	151.96	43.38	142	.44	.88

Table 17. Classification Accuracy and Two Proportions Test for ELL Subgroup Analysis

Measure	Group	N	AUC	*p*	Sens.	*p*	Spec.	*p*	PPV	*p*	NPV	*p*	Overall	*p*
Fall LNF	ELL	53	.777	.736	77.1	.042	76.5	.029	87.1	.016	61.9	.005	76.9	.963
	Non ELL	209	.798		62.2		85.6		70.8		80.1		77.2	
Fall LSF	ELL	53	.616	.074	82.9	.763	29.4	<.001	70.7	.011	45.5	<.001	65.4	.989
	Non-ELL	209	.740		81.1		56.8		51.3		84.3		65.5	
Fall PSF	ELL	53	.620	.643	88.6	.006	17.6	<.001	68.9	<.001	53.4	.010	65.4	.085
	Non ELL	208	.654		70.0		42.4		40.2		71.8		52.2	
Fall NWF	ELL	53	.717	.325	82.9	.034	52.9	.099	78.4	<.001	60.0	.005	73.1	.338
	Non-ELL	207	.781		68.1		65.2		51.6		78.9		66.2	
Fall DRA2	ELL	50	.702	.342	56.3	<.001	76.5	<.001	81.8	.400	48.1	.002	63.3	.220
	Non ELL	190	.767		25.4		96.0		76.2		71.7		72.2	
Winter PSF	ELL	51	.572	.637	84.8	.096	11.8	<.001	65.1	.002	28.6	<.001	60.0	.341
	Non ELL	214	.608		73.7		40.7		41.2		73.3		52.6	
Winter NWF	ELL	51	.806	.559	75.8	.124	76.5	.456	86.2	<.001	61.9	.016	76.0	.319
	Non-ELL	215	.768		64.5		71.3		55.7		78.2		68.9	
Winter R-CBM	ELL	51	.778	.175	75.8	.859	70.6	.159	83.3	.015	60.0	<.001	74.0	.540
	Non ELL	198	.856		74.6		79.7		65.8		85.7		78.0	
Winter DRA2	ELL	44	.700	.054	63.3	.017	69.2	<.001	82.6	.912	45.0	<.001	65.1	.114
	Non ELL	166	.830		43.1		95.3		83.3		75.4		76.8	

Table 18. Classification Accuracy and Two Proportions Test for FRL Subgroup Analysis

Measure	Group	N	AUC	*p*	Sens.	*p*	Spec.	*p*	PPV	*p*	NPV	*p*	Overall	*p*
Fall LNF	FRL	123	.750	.111	67.5	.732	74.4	.002	83.1	<.001	55.2	<.001	69.9	.006
	Non FRL	139	.830		65.5		89.1		61.3		90.7		84.2	
Fall LSF	FRL	123	.679	.917	85.0	.014	44.2	.034	73.9	<.001	61.3	<.001	70.7	.081
	Non FRL	139	.685		72.4		57.3		30.9		88.7		60.4	
Fall PSF	FRL	122	.663	.086	83.5	<.001	27.9	.013	68.0	<.001	48.0	<.001	63.9	.003
	Non FRL	139	.559		55.2		42.7		20.3		78.3		45.3	
Fall NWF	FRL	121	.712	.341	78.2	<.001	51.2	.002	74.4	<.001	56.4	<.001	68.6	.863
	Non FRL	139	.764		58.6		70.0		34.0		86.5		67.6	
Fall DRA2	FRL	111	.699	.339	41.4	<.001	85.4	.001	82.9	<.001	46.1	<.001	57.7	<.001
	Non FRL	129	.754		20.0		97.1		62.5		83.5		82.2	
Winter PSF	FRL	124	.603	.751	76.3	.557	29.5	.035	66.3	<.001	40.6	<.001	59.7	.099
	Non FRL	141	.622		79.3		42.0		26.1		88.7		49.6	
Winter NWF	FRL	124	.724	.188	68.8	.568	61.4	.009	76.4	<.001	51.9	<.001	66.1	.165
	Non FRL	142	.793		65.5		76.1		41.3		89.6		73.9	
Winter R-CBM	FRL	120	.793	.069	75.3	.800	72.1	.060	82.9	<.001	62.0	<.001	74.2	.227
	Non FRL	129	.852		73.9		82.1		47.2		93.5		80.6	
Winter DRA2	FRL	97	.740	.125	57.6	<.001	77.4	<.001	84.4	.094	46.2	<.001	63.9	<.001
	Non FRL	113	.827		27.3		97.8		75.0		84.8		84.1	

CHAPTER 5

DISCUSSION

This investigation examined the properties of first-grade reading assessments employed for the purpose of screening within a multi-tiered instructional model meant to prevent later reading failure. Because illiteracy is associated with a multitude of poor outcomes, a primary concern of first-grade educators is ensuring that children acquire the appropriate foundational skills to support future reading achievement. Unfortunately, without intervention, students who show reading deficits in early elementary years are very likely to fall even further behind their classmates (Juel, 1988). Universal screening is frequently used in elementary schools to identify which students are at risk and to provide timely intervention. In recent decades, a great deal of research has focused on identifying the salient foundational reading skills that predict later success. However, these important skills are not always the constructs represented on early reading assessments used for the purpose of screening, meaning that children may be misidentified as on track and subsequently not provided with intervention until it is too late. In this study, the Aimsweb TEL and the DRA2, two types of screening tools developed based on contradicting models of the reading process and theories of reading development, were investigated for appropriateness and usability, as well as tested for predictive validity and classification accuracy on third-grade outcomes. Appropriateness and usability were examined through review of test materials, as well as a questionnaire targeted towards first-grade teachers. Technical characteristics were examined through review of evidence available from test publishers, as well as analysis of longitudinal test data from two cohorts of elementary students, totaling 269 participants. This study

replicates previous research to add to the existing literature base on the psychometric properties of early literacy CBM, and represents a preliminary examination of these properties of IRIs.

Summary of Findings

Appropriateness for Intended Use and Usability of Screening Measures

In chapter two, theoretical and empirical evidence describing the typical trajectories of early reading development was reviewed, and test materials available from the publisher of the Aimsweb measures and the DRA2 were critically examined for evidence of alignment with the reading skills that have been identified as predictive of later reading development. It was determined that the first-grade Aimsweb reading assessments are highly aligned with reading related-skills critical to early literacy development based on the code-based theories of reading development that have robust empirical support to predict later reading achievement. These skills include phonological awareness, understanding of the alphabetic principal and ability to use letter sound associations to decode words, and - later in first-grade - fluency with connected text. The DRA2, on the other hand, appears aligned to the psycholinguistic theory of reading, and thus does not explicitly measure the constructs of phonological awareness or decoding ability. Rather, at the earliest levels this assessment seems to assess students' oral language proficiency by focusing on students' ability to use semantic and syntactic cues, as well as the ability to gather cues from illustrations. Beginning at DRA2 level 16, which many participants in this study reached by the winter of first-grade, fluency with connected text *is* indeed reflected in the constructs measured.

In addition, usability evidence for each assessment was considered in the review of test materials. Expected administration time is significantly longer for the DRA2 (estimated 10-20 minutes for first-graders) compared to the set of Aimsweb probes (5-7 minutes for first-graders). In terms of financial costs, the DRA2 includes more upfront expenses, but beyond the initial purchase, the cost to access data management capabilities of both systems are comparable. Understanding teachers' perceptions of the usability characteristics of each tool was one purpose of the educator questionnaire. The overall agreement with statements related to usability was not significantly different for the DRA2 and Aimsweb. Given the longer administration time associated with the DRA2, it was somewhat surprising that respondents did not report this. A possible explanation is the fact that only two respondents were classroom teachers (who administer the DRA2), while six were reading specialists or intervention teachers (those who are responsible for Aimsweb administration). Indeed, one intervention teacher noted that, the Aimsweb administration is, "*very time consuming and intervention groups have to be cancelled for at least a week if not more"*. Interestingly, there was a negative correlation between those who believed there were enough resources allocated to each assessment. Teachers who rated one higher, consistently rater the latter lower, which may indicate that they perceived too little resources allocated to their preferred assessment and enough allocated to their less preferred assessment.

The primary purpose of the educator questionnaire was to gather information regarding the inferences that first-grade classroom teachers, special educators, and reading specialists in the participating school district make based on the results of the Aimsweb measures and DRA2. Based on the input of twelve educators, it was discovered

that while a numerical measure of agreement with various purposes of assessment did not differ significantly for each tool, differences emerged in teachers' qualitative comments. For the DRA2, teachers were most likely to say that the assessment helps them understand students' instructional reading levels, and provides an opportunity to observe oral reading so that teachers can identify what strategies students are currently using to decode text, and develop instructional targets based on these needs. While these purposes are primarily diagnostic, teachers' comments related to the Aimsweb measures were more likely to relate to screening, as well as measuring student outcomes. Further, it is noted that while comments related to purposes of the DRA2 were in many cases quite detailed, the same comments related to purposes of Aimsweb were in many cases brief and vague, for example, "*normed results*" or "*performance assessment*". Further, there was indication that teachers believe that both the DRA2 and Aimsweb results are to inform district level questions – for example, general trends over time, and how students respond to implementation of new reading programs.

The questionnaire results revealed an apparent difference in the way that the two assessments under investigation are being used in this district. Compared to IRIs, respondents were less likely to have training in administering and interpreting the results of early literacy CBM. Correspondingly, teachers were better able to express how the DRA2 results were directly used to inform classroom instruction. The Aimsweb package was perceived to be more related to school and district level efforts to identify students at risk, and monitor student outcomes.

Teacher support for the DRA2 is unsurprising given the similarity between DRA2 materials and procedures and the expectations for young children in guided reading

classrooms. As noted by Pikulski (1974), IRI testing procedures approximate procedures that are typically used to teach reading in whole language classrooms. Results of the questionnaire that indicate support for the use of the DRA2 are also consistent with the strong face validity reported by the publisher (Pearson, 2011c).

Technical Adequacy of Screening Measures

As Pikulski argued in his 1974 critique of IRIs, the face validity of IRI procedures is important evidence of their value in classrooms when they are truly used "informally". Yet once they are used for purposes with consequences beyond daily classroom decisions, they should be subjected to the same requirements of technical adequacy as any other assessment. Pikulski further noted that it may be precisely *because of* this face validity that so little research had been conducted on IRIs. Decades later, despite a great deal of research on how reading develops in young children and the assessment implications of this developmental path, there remains a paucity of empirical studies that examine the properties of IRIs with respect to their use in educational decision-making.

This study's second set of research questions pertained to the predictive validity and classification accuracy of the screening measures in question. The first of these questions sought to estimate how much of the variance in third-grade state standardized test reading scores is predicted by fall and winter first-grade performance on each of the measures being investigated. When the Aimsweb scores were combined into a composite, in most cases they predicted a similar amount of variance as the DRA2. These data are not surprising. As more general reading behaviors were assessed, the relationship between early reading behaviors and later ones would be similar. Depending on the screening period and cohort, single Aimsweb probes also predicted as much or more

variance than the DRA2. For example, fall NWF and LSF screeners had a stronger correlation to third-grade ORF and MCAS than the broader fall DRA2 measure. This finding may indicate, consistent with the code-based theories, that the assessment of decoding is more relevant at the start of first-grade than measuring broader oral language and comprehension skills represented in the early forms of the DRA2.

For both cohorts, the winter DRA2 scores were more predictive than the fall DRA2 scores. This is likely related not only to the closer proximity between the administration of predictor and outcome measures, but also to the fact that the higher levels of the DRA2 assessment that include text reading fluency and are typically administered to first-graders in the winter are more highly aligned to the developmental reading skills of the time period, in which students move from the decoding stage and fluency with connected text emerges as the strongest indicator of reading ability (Chall, 1996; Jenkins, et al. 2007).

While the correlational and regression analyses provide evidence of the predictive relationship between the first-grade assessments and later reading proficiency, when evaluating the technical adequacy of assessments used for the purpose of screening, it is crucial to understand the classification accuracy of each tool, which provides indices of utility in identifying students who are on track, or who are in need of intervention. The fourth research question considered the classification accuracy of the fall and winter first-grade DRA2 and Aimsweb screening measures for this sample using published cut points for risk, and subsequently sought to improve the classification accuracy of each measure by establishing more sensitive cut points for risk status.

In most cases, the Aimsweb classification accuracy statistics were similar to previously published studies (e.g., Goffreda et al., 2009; Silberglitt & Hintze, 2005). For example, consistent with previous investigations, winter R-CBM emerged as the most predictive first-grade subtest. Also consistent with previous research, PSF generally identified an adequate percentage of first-graders at risk, yet resulted in very low specificity levels, meaning that high rates of false positives were observed. While this consequence is less problematic than false negatives, it questions the utility of the PSF measure to efficiently allocate resources.

Use of the DRA2 as a screening tool resulted in low levels of sensitivity (ranging from 30.7-50.0), and high levels of specificity (ranging from 92.2-95.2). Effectively, this means that when first-graders reach the recommended benchmark levels on the DRA2, it is not necessarily indicative of later success on an outcome measure in third-grade. On the other hand, when first-graders *do not* meet the recommended level, it is very unlikely that they will go on to reach proficiency on the outcome measure, whether it be a reading achievement test or oral reading fluency. PPV values for the DRA2 predicting MCAS success ranged from 79.2 to 87.5, meaning that there is a high probability that a risk status on the DRA2 in first-grade indicates later difficulty, yet NPV values ranged from 57.8 to 65.4, meaning that even when a student reaches the DRA2 benchmark score, there is at least a 35% chance that they will struggle to reach proficiency on a standardized test of reading in third-grade. The NPV values for the DRA2 improved slightly when R-CBM was used as the third-grade outcome measure, with a negative result on the DRA2 meaning a 71.4% chance of achieving proficiency. While no previous published investigations of IRIs examined classification accuracy for first-graders, a study

conducted with a sample of second and third-graders found similar trends of low sensitivity of these tools (Parker et al., 2015).

As was seen in the regression analyses, the winter first-grade DRA2 scores were more useful in predicting third-grade outcomes than the fall DRA2 scores, with sensitivity improving from fall to winter and specificity remaining high. Again, this likely reflects the alignment between the higher DRA2 levels and the important indicators of reading ability in second semester first-graders, namely, fluency with connected text.

On the whole, first-grade screening tools were less predictive of third-grade achievement scores for Cohort 2 than they were for Cohort 1. There are two possible explanations for this. First, upon the time Cohort 1 entered first-grade, the participating school district adopted a code based early reading curriculum for grades K-2. Previous to that, a guided reading approach was employed, although individual teachers incorporated code based instruction to various degrees. However, despite this change, the cohorts did not perform significantly differently except in the winter NWF measure, in which Cohort 2's mean score was significantly higher (t (264) = 3.59, p <. 001). As will be explored further in discussion of this study's limitations, it is possible that access to tier I instruction that emphasized foundational skills, as well as targeted intervention for at risk students, resulted in a weaker relationship between first-grade screening measures and the MCAS. This indeed appears to be a viable explanation in the case of NWF, for which Cohort 2 showed fewer true positive screening results than Cohort 1, yet also significantly more false negatives, resulting in lower sensitivity for Cohort 2 than is typically reported for NWF. It is possible that direct teaching of decoding skills in first-grade allowed students to perform well enough to pass the screening test, but first-grade

success in this skill did not reflect the higher-level skills needed to be on track for later overall reading proficiency.

However, upon examination of the correlation coefficients, it is noted that even R-CBM administered at the same time as MCAS was less predictive in Cohort 2 than in Cohort 1. This suggests that the more likely explanation for the differential relationship is that the proficiency expectations of the MCAS test changed between Cohort 1 and Cohort 2. The newer test emphasizes assessment of higher level critical thinking skills that may be less closely correlated to basic oral reading ability.

Examination of the classification accuracy for each screening measure revealed the cutpoints recommended by the publishers did not elicit the .90 sensitivity threshold, or the .80 specificity threshold recommended by Compton et al. (2006) and Jenkins, et al. (2007). After obtaining classification accuracy statistics for the publisher recommended cut scores, third-grade R-CBM scores were used as an outcome and ROC curves were generated to obtain cut scores that would result in sensitivity rates above .80, and above .90 as recommended by Jenkins et al. (2007). For most subtests, holding sensitivity at higher levels led to lower rates of overall correct classification, as specificity was compromised by the increase in sensitivity. For the Aimsweb screeners, when sensitivity was increased to .90, resulting specificity was similar to levels obtained in previous investigations of early literacy CBM (see chapter 2, table 3, e.g., Johnson, et al., 2009; Catts, et al., 2009; Clemens et al., 2011, Riedel, 2007), despite the fact that these most of studies did not employ third-grade state achievement tests as the outcome measures. The classification accuracy of the DRA2 has not been previously studied in first-graders.

For many measures, cut scores needed to be increased quite dramatically in order to attain sensitivity of .90. For example, the R-CBM cut score was increased from 30 words read correctly to 63. According to the Aimsweb National Norms, a score of 63 words per minute would be achieved by students at the 72nd percentile in the winter of first-grade (Pearson, 2014). In order to obtain a sensitivity of .90, the fall DRA2 cut score needed to be increased from level 3 to level 12, and the winter first-grade DRA2 benchmark needed to be increased from Level 8 to Level 24. According to the publisher, Level 24 is expected in mid to late second grade (Pearson, 2011c).

This study's fifth research question was an inquiry into the differential classification accuracy of each tool for English language learners and students who are eligible for free or reduced lunch. Given the disparities between educational achievement of majority and minority groups (U.S. Department of Education, 2015), it is not surprising that across screening tools and outcome measures, students who were ELLs or received FRL performed less well. Examination of the classification accuracy statistics for ELLs compared to proficient English speakers reveals that in general, given the publisher recommended cut scores, sensitivity was improved, and specificity decreased; fall LNF, PSF, NWF and DRA2, as well as winter DRA2 were significantly better at identifying ELLs at risk than non-ELLs at risk. Similar patterns were observed for FRL students vs. non FRL students. This suggests the need for additional consideration, and perhaps alternate cut scores when these tools are used to identify student from these subgroups who are in need of intervention. As an example, while results of the previous research question suggest that for this study's population as a whole, cut scores should be increased to improve sensitivity, raising those cut scores may result in less efficient

screening decisions for ELLs. These results are consistent with other studies that have suggested consideration of alternate cut scores for subgroups (Hosp et al., 2011; Johnson et al., 2009), and also illustrate the importance of cross validation when using post hoc selection of cut scores that may not generalize to different populations.

Each measure analyzed in the present study was a test of reading or its the sub-component skills; thus, it is not surprising that the first-grade variables were generally correlated with and predictive of later reading proficiency. However, despite moderate correlations between the Aimsweb Composite and DRA2 and the outcome measure, these two screening approaches differentially predicted which students were at risk. Using the publishers' cutpoints, students who were identified by the DRA2 as likely to encounter reading difficulties were more likely to do so than students identified as at risk by the Aimsweb measures. However, more concerning is that the DRA2 was also much less likely to identify struggling readers who may need intervention than were the Aimsweb subtests. Each and every one of the Aimsweb TEL measures demonstrated greater sensitivity than the DRA2 administered at the same time, meaning that they correctly identified more students at risk. Interestingly, the survey results revealed that classroom teachers thought the TEL and the DRA2 would identify struggling readers similarly. Yet they were significant more likely to say that TEL measures over identified students as at-risk. Indeed, we found the latter to be true, with greater false positive rates observed using the TEL. Yet the TEL screening measures were more likely to draw attention to the right students in need of more reading support.

These findings provide evidentiary support that the basic skills assessed using the TEL are better aligned with important literacy constructs that predict later reading

achievement than the broad reading construct measured in the DRA2. Students who met the DRA2 cut score in many cases did not meet cut scores on the individual TEL subtests, and subsequently did not perform proficiently on the third-grade MCAS or R-CBM. Given that false negative predictions often mean that students do not receive intervention in a timely manner, these results are worrisome.

Integration of Data

This study's final research question asked whether the inferences and decisions made based on screening results are supported by the constructs assessed in each measure and by the predictive validity evidence. On the questionnaire, educators endorsed statements related to screening for both Aimsweb and the DRA2. Examination of the relevant constructs revealed that Aimsweb does measure the appropriate first-grade foundational skills that align to later reading success. Further, it is efficient to administer and has stronger psychometric properties for screening. Still, the results of this study confirm what has been noted by previous investigations of the classification accuracy of early literacy CBM. Namely, that when used alone, screening measures such as LNF, PSF and NWF are inadequate as screening tools. As will be considered later in discussion of implications, the relative ability of these tools to minimize false negative results makes them appropriate as the first gate in a multistep screening process.

However, neither review of the DRA2 content, nor the predictive validity evidence obtained in this study supports the use of the DRA2 as a screening tool, as it results in high levels of problematic false negative identifications. Given the additional time required to administer the DRA2, and its poor utility in identifying students at risk of later reading problems, it's use as a screening tool cannot be recommended.

While screening was endorsed as a purpose of the DRA2, teachers' responses to open ended questions indicated that the DRA2 is used primarily for diagnostic decisions. IRIs such as the DRA2 do allow for more time to systematically observe students than individual Aimsweb probes and may provide valuable qualitative information about a student's skills, which can be analyzed in order to inform instruction. However, it should be reiterated that the DRA2 does not include a direct assessment of phonological awareness or decoding skills, and therefore it's utility for diagnosing reading problems and informing instruction must be called into question when used with young children who are not yet able to read with fluency. Further, the validity of instructional decisions made based on IRI data has not been tested and disseminated for educators to evaluate.

Despite these findings, it is evident from previous literature, and from the limited respondents to this study's questionnaire that teachers appreciate the value IRIs as an opportunity to observe students' reading behavior in a structured way, and as a way to match students to texts. On the other hand, the results of the questionnaire also indicate that the use of early CBM may not be well understood by all teachers, and that CBM is not as relevant to the instructional decisions made by classroom teachers. This has implications for schools who adopt early literacy CBM screening tools. As has been described previously, early literacy CBM probes are highly aligned to the skills that predict later reading achievement and their technical properties have been vetted in a way that those of IRIs have not. The conclusion that CBM screening tools are not well understood by teachers is suggestive of a missed opportunity to adequately target students who may benefit from more intensive literacy intervention. Care should be taken to ensure that professional development is provided to teachers who work directly with

students, so that they understand how the data can be used for making instructional decisions within the classroom, as well as at the building or district level. In doing so, teachers should also be made aware of the limitations of these assessments when making decisions.

Implications

The results of this study have other important implications for universal screening within an RTI framework. Effective tools identify as many at risk children as possible, while minimizing the number of false positive identifications. This study assumed the use of a direct route approach to screening, in which intervention decisions are made based on administration of the screener, or combination of screeners at one point in time. Screening approaches that combine several measures, such as the TEL, typically lead to better accuracy than single measures (Jenkins et al., 2007). Also of promise are gated screening approaches that employ universal screening measures as a first stage, followed by further assessment of students potentially at risk.

In their discussion of technical adequacy for screening tools, Glover and Albers (2007) note that in such multi-level screening systems, sensitivity is a priority at the first gate, while the goal of subsequent screening gates is to increase PPV. Previous exploration of the classification accuracy of early literacy CBM has established that these tools are better able to identify students who are adequate readers (not at risk), than they are able to identify those students who are at risk (Nelson, 2008). In a classification accuracy study of the DIBELS, Nelson (2008) noted that CBM early literacy screeners are effective as exclusionary measures, ruling out those who are mostly likely to go on to learn to read without intervention, but not effective as inclusionary measures because

they produce more false positives. Therefore, when using these tools, further screening as part of a multistep process is warranted. If secondary assessment confirms that students are at risk, resources can be allocated for intervention. Secondary assessment may come with additional costs, but tools are administered to a much smaller subset of students after true negatives have been eliminated. Another viable option would be to monitor the progress of students found to be at risk on the screening tool. In a study of first-graders, Compton et al. (2010) found that false positives could be decreased by short periods of progress monitoring after the initial screening period.

Finally, the finding that relying on one set of cut scores results in differential classification accuracy for subgroups of learners has important implications for practice. As noted by Hosp et al. (2011) and Johnson et al. (2009), schools should consider disaggregating screening results, and also bear in mind the importance of using other data to validate screening decisions.

Limitations

Several limitations to the present study must be considered. First, this study's investigation of technical adequacy employed pre-existing data collected by the participating school district. Therefore, specific procedures for collecting data, and information regarding the reliability of assessment administration are not known to the researcher. While the data was gathered in a way that reflects typical school practice, precise information regarding how data was collected by school staff would support understanding of the reliability of each measure and in turn generalizability to other settings.

Related to the educator questionnaire, qualitative data collection typically focuses on the insight of a small number of respondents with intimate knowledge of the matter at hand, and indeed the respondents to the survey made decisions about their students based on the assessment data analyzed in this study. However, another limitation of this study is the limited number of first-grade educators that completed the questionnaire. Further, the sample included a relatively small representation of classroom teachers. Had more teachers offered their input, it would be more likely that results could be generalized to other settings. Future research might include a larger scale investigation into teachers' use and interpretation of CBM and IRIs when used as screening tools.

Additionally, the third-grade MCAS scores represent results of a standardized test of English Language Arts, and may not directly reflect overall reading comprehension skills, as scores are derived not only from correct responses to multiple choice questions, but also written responses. Students who were proficient readers but had difficulty in written expression may not reach proficiency according to this measure. This is reflected in the merely moderate correlation between MCAS and R-CBM administered concurrently. While the MCAS and R-CBM were the only available outcome measures in this dataset, there may be better criterion measures by which to establish reading proficiency in third-grade. Another, related limitation is the aforementioned change to the MCAS content and expectations that occurred between Cohort 1 and Cohort 2. In addition, the reading curriculum was changed at the same time. Without the threat of these extraneous variables, it would be possible to draw more conclusive inferences regarding the predictive validity of each tool in this specific setting.

A further limitation is the fact this study did not take into account student participation in reading intervention programs between the first-grade screening periods and the spring of third-grade. As part of the school's RTI practices, students at risk based on screening results may have been offered targeted reading intervention. However, it is not known exactly which children received this intervention, nor to what degree. It is likely that students received intervention based on the results of first-grade screening measures, and that these interventions changed the trajectory of reading development and potentially biased predictive validity of the measures. Therefore, false positives could be related to effects of instruction that occurred between administration of the screener and outcome measure. This threat to validity is difficult, if not impossible, to overcome in educational settings, where teachers and school systems are tasked with identifying student's needs and attempting to meet them. However, future research should attempt to control for these effects by considering participants' intervention status in analyses.

Contributions to Extant Research and Future Directions

This study provides further evidence to support the use of early literacy CBM as part of universal screening practices, and calls into question the use of IRIs for such purposes. Previous investigations of the predictive validity and classification accuracy of IRIs (e.g., Parker et al. (2015); Klingbeil, et al. (2015)) have looked at the use of these measures with second and third-grade students, who have typically moved past the decoding stage and are building fluency. This study represents an initial inquiry into the use of these measures in first-graders. Future research should not only cross validate these findings with additional first-grade samples, but could also investigate the predictive utility of IRIs administered even earlier. IRIs are commonly used as early as

kindergarten to make educational decisions about young children. Based on the results of this study, in which winter of first-grade DRA2 was more predictive than the fall administration, it is hypothesized that kindergarten DRA2 would be even more likely to under identify students at risk, as many children are able to read familiar, repetitive text with the support of illustrations before they have developed the foundational skills necessary to later reading success.

The results of this study have implications for the use of early literacy CBM in gated screening models, and their use in this way should continue to be investigated. While this study invalidates the use of the DRA2 as a universal screener, it may be an appropriate tool for gathering more information about individual students who have been identified as at risk by brief indicators. More research regarding the use of IRIs in RTI frameworks in warranted. Another direction for future research would be a large-scale investigation into how teachers use IRIs in tiered reading models. There is agreement in the literature that IRIs are supported by teachers, yet few large scale investigations into their current use. As one example, Arthaud, Vasa, & Steckelberg (2000), found that among 400 special educators in four midwestern states, respondents were more likely to use IRIs than CBM Oral Reading Fluency in their assessment practices. In another survey of over 1500 K-2 teachers who employed a guided reading approach, 75% indicated that they used IRIs and or running records for the purpose of diagnostic assessment (Ford & Optiz, 2008). However, these surveys did not ask specifically about the use of IRIs as screening tools or as part of RTI frameworks. Future inquiry in this area would also provide insight into the ways that the use of assessments such as the DRA2 may be

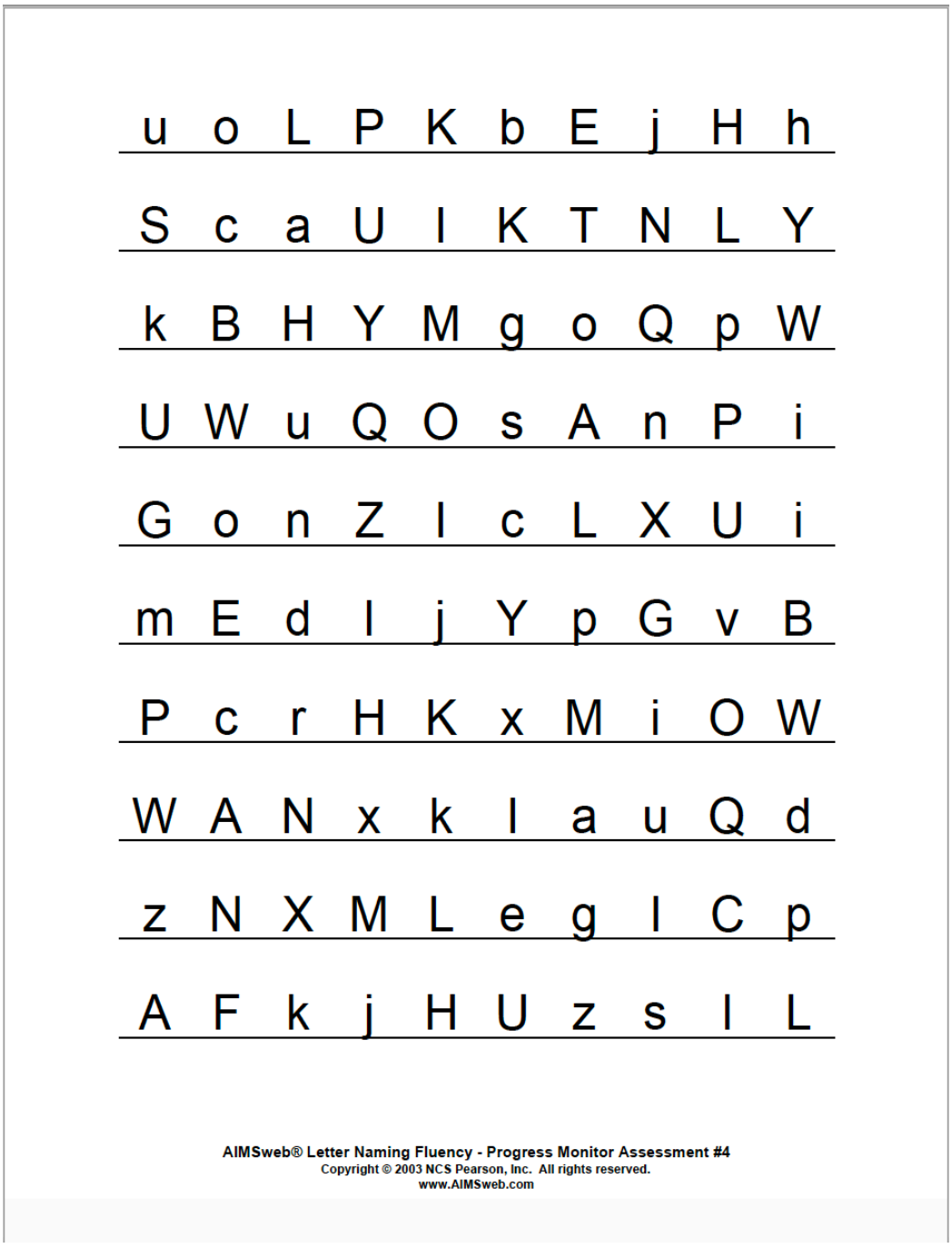
changing in the face of reading reform and newfound emphasis on data-based decision-making in the field.

APPENDICES

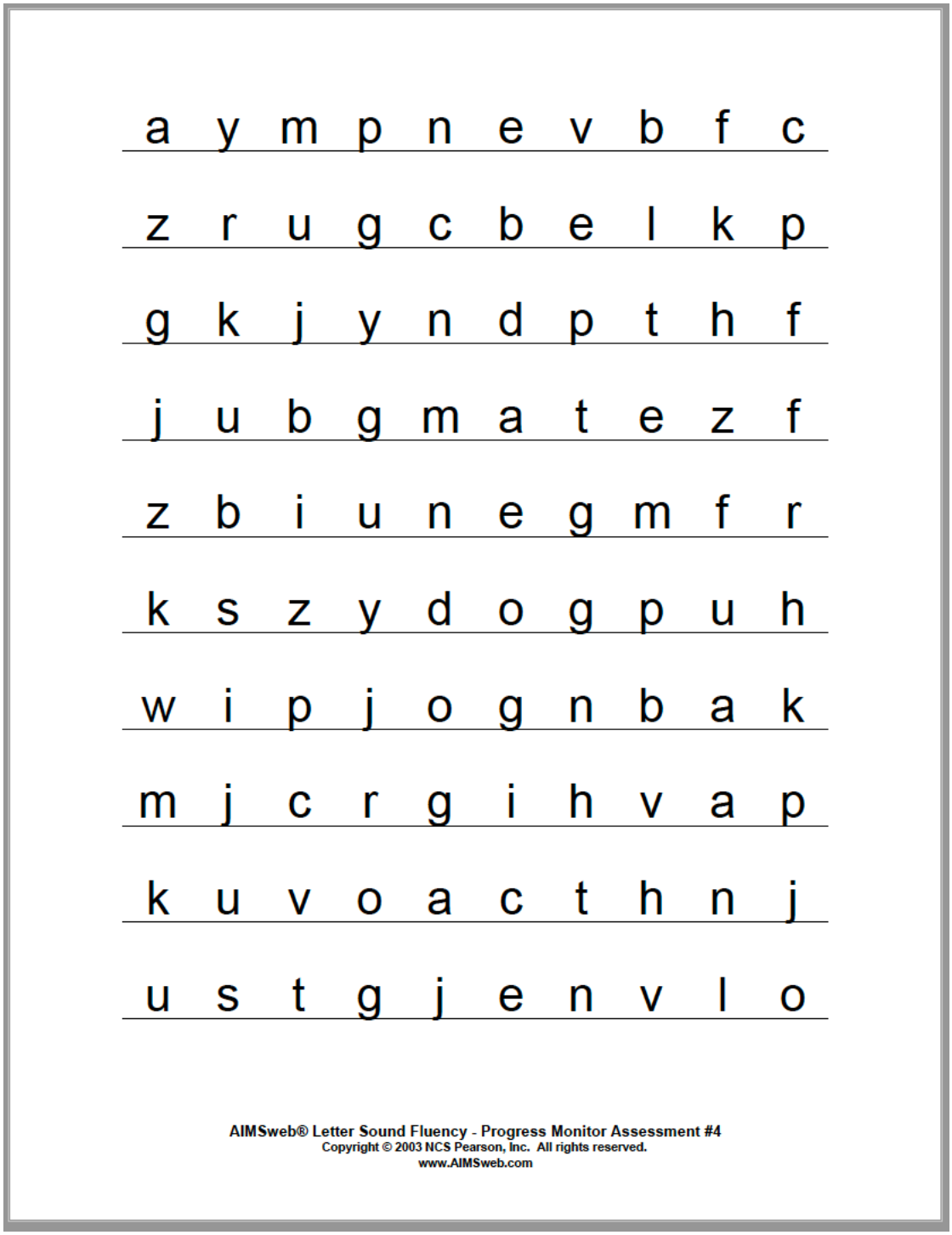
APPENDIX A

SAMPLE AIMSWEB PROBES

Letter Naming Fluency



Letter Sound Fluency



Phoneme Segmentation Fluency

AIMSweb® Phoneme Segmentation Fluency - Progress Monitor Assessment #5

Given To: _____ Given By: _____ Date: _____

french	/f/ /r/ /e/ /n/ /ch/	hung	/h/ /u/ /ng/	/ 8 (8)
marked	/m/ /ar/ /k/ /t/	ranch	/r/ /a/ /n/ /ch/	/ 8 (16)
meet	/m/ /ea/ /t/	brook	/b/ /r/ /uu/ /k/	/ 7 (23)
church	/ch/ /ir/ /ch/	fact	/f/ /a/ /k/ /t/	/ 7 (30)
trap	/t/ /r/ /a/ /p/	teeth	/t/ /ea/ /th/	/ 7 (37)
heads	/h/ /e/ /d/ /z/	tie	/t/ /ie/	/ 6 (43)
than	/th/ /a/ /n/	leave	/l/ /ea/ /v/	/ 6 (49)
rock	/r/ /o/ /k/	safe	/s/ /ai/ /f/	/ 6 (55)
pass	/p/ /a/ /s/	king	/k/ /i/ /ng/	/ 6 (61)
clear	/k/ /l/ /ea/ /r/	rooms	/r/ /oo/ /m/ /z/	/ 8 (69)
how	/h/ /ow/	sign	/s/ /ie/ /n/	/ 5 (74)
nap	/n/ /a/ /p/	reach	/r/ /ea/ /ch/	/ 6 (80)
young	/y/ /u/ /ng/	bed	/b/ /e/ /d/	/ 6 (86)
him	/h/ /i/ /m/	dough	/d/ /oa/	/ 5 (91)
skin	/s/ /k/ /i/ /n/	hole	/h/ /oa/ /l/	/ 7 (98)

/ ____

Nonsense Word Fluency

noj	vez	ruz	biv	yep
nof	lal	jon	duv	luk
sij	yuc	mod	lef	hus
mij	vis	kuj	jep	miz
wip	pez	fik	vug	az
non	kat	jik	pas	joz
nik	ret	od	lic	dop
kos	muv	jid	sus	tos
zuc	laf	het	kuc	yub
woj	fos	og	rev	wij
wef	jof	yug	iz	fav
muz	nav	mac	vuz	bik
tud	veb	pep	wal	sid
suz	mav	hij	yob	nov
vom	yec	ic	hej	hon

Oral Reading Fluency (R-CBM)

A boy named Tom was at the bus stop. He was waiting for the school bus. There was no one there but him. The bus was late.

Tom began to talk to himself. "Maybe the bus forgot me," he said.

Then Tom heard a dog barking. He looked up and saw his dog, Spot, running down the road. Spot ran to Tom. He was so happy to see Tom that he jumped into Tom's arms.

Just then, Tom heard the bus coming. He didn't have time to take Spot home. There was no time to think. Tom grabbed Spot and hid him under his coat.

The bus pulled up to Tom's bus stop. Tom got on the bus and went to the back. His friend Jack had saved a seat for him.

Just as Tom sat down, a little yelp came from under his coat.

"What do you have under there, Tom?" asked Jack.

"If I tell you, do you promise not to tell?" replied Tom.

"You bet. I'm your best friend, aren't I?" asked Jack.

Tom told Jack what had happened. He asked his friend what he should do. Jack had an idea.

"You can tell the teacher you have something very cool for show and tell. Then you could call your mom and have her come and pick up Spot."

Tom decided that's what he would do. His teacher was surprised. His mom was mad, but Spot was very happy.

APPENDIX B

SAMPLE DRA2 TEACHER OBSERVATION GUIDE

Teacher Observation Guide | ***Duke*** | Level 8, Page 1

Name/Date _____ Teacher/Grade _____

Scores: Reading Engagement ___/8 Oral Reading Fluency ___/16 Comprehension ___/28
Independent Range: 6–7 11–14 19–25

Book Selection Text selected by: ☐ teacher ☐ student

1. READING ENGAGEMENT

(If the student has recently answered these questions, skip this section.)

T: Tell me about one of your favorite books. _____

T: Do you like to read ☐ ***alone,*** ☐ ***with a buddy, or*** ☐ ***with a group?***

Why? _____

T: Whom do you read with at home? _____

2. ORAL READING FLUENCY

INTRODUCTION AND PREVIEW

T: In this story, **Duke**, ***a boy named Jim has a black-and-white dog named Duke. Duke can do lots of tricks. Look at the pictures, and tell me what is happening in this story.***

Note the student's use of connecting words (e.g., *and*, *then*, *but*) and vocabulary relevant to the text. You may use general prompts, such as "Now what is happening?" or "Turn the page," but do not ask specific questions. Tally the number of times you prompt.

RECORD OF ORAL READING

Record the student's oral reading behaviors on the Record of Oral Reading below and on the following page.

T: **Duke.** ***Now, read to find out what Duke can do.***

Page 2

Jim had a dog. The dog was black and white. The dog's name was Duke.

Page 3

Duke was a big dog. He had big feet. Jim liked his dog.

Page 4

Duke liked to play with Jim.
He could do lots of tricks.
He could sit up and shake
hands. "Good dog!" said Jim.

Page 5

He could jump over a stick.
"Good dog!" said Jim.

Page 6

Jim could throw a ball and
Duke could get it. "Good dog!"
said Jim.

Page 7

Duke liked to lick Jim's face, too.
He was a good dog!

ORAL READING, PERCENT OF ACCURACY

Count the number of miscues that are not self-corrected. Circle the percent of accuracy based on the number of miscues.

Word Count: 87

	EM	DEV	IND			ADV		
Number of Miscues	7 or more	6	5	4	3	2	1	0
Percent of Accuracy	92 or less	93	94	95	97	98	99	100

- If the student's score falls in a shaded area, STOP! Reassess with a lower-level text.
- If the student is reading below the grade-level benchmark, administer *DRA Word Analysis,* beginning with Task 8, at another time.

3. COMPREHENSION

RETELLING

As the student retells, underline and record on the Story Overview the information included in the student's retelling. Please note the student does not need to use the exact words.

T: Close the book, and then say: ***Start at the beginning, and tell me what happened in this story.***

Story Overview

Beginning

1. Jim has a black and white dog with big feet named Duke.
2. Duke likes to play with Jim, and he can do lots of tricks.

Middle

3. Duke sits up and shakes hands, and Jim says, "Good dog!"
4. Duke jumps over a stick, and Jim says, "Good dog!"
5. Duke gets the ball, and Jim says, "Good dog!"

End

6. Duke likes to lick Jim's face. Duke is a good dog.

If the retelling is limited, use one or more of the following prompts to gain further information. Place a checkmark by a prompt each time it is used.

- ☐ ***Tell me more.***
- ☐ ***What happened at the beginning?***
- ☐ ***What happened before/after*** _____ (an event mentioned by the student)***?***
- ☐ ***Who else was in the story?***
- ☐ ***How did the story end?***

REFLECTION

Record the student's responses to the prompts and questions below.

T: What part did you like best in this story? Tell me why you liked that part.

MAKING CONNECTIONS

Note: If the student makes a text-to-self connection in his or her response to the above prompt, skip the following question.

T: What did this story make you think of? or ***What connections did you make while reading this story?***

4. TEACHER ANALYSIS

ORAL READING

If the student had 5 or more different miscues, use the information recorded on the Record of Oral Reading to complete the chart below.

<table>
<tr><td rowspan="2">Student problem-solves words using:
☐ pictures
☐ beginning letter/sound
☐ letter-sound clusters
☐ onset and rime
☐ blending letters/sounds
☐ rereading
☐ no observable behaviors</td><td colspan="2">Number of miscues self-corrected: ____
Number of miscues not self-corrected: ____
Number of words told to the student: ____</td></tr>
<tr><td>Miscues interfered with meaning:
☐ never
☐ at times
☐ often</td><td>Miscues included:
☐ omissions
☐ insertions
☐ substitutions that were
☐ visually similar
☐ not visually similar</td></tr>
<tr><td colspan="3">Copy each substitution to help analyze the student's attention to visual information.
e.g., <u>have</u> (substitution)
had (text)</td></tr>
</table>

DRA2 Continuum

- Circle the descriptors that best describe the student's reading behaviors and responses.
  1. Use your daily classroom observations and the student's responses to the Reading Engagement questions to select statements that best describe the student's level of Reading Engagement.
  2. Use your recorded observations from this assessment to select the statements that best describe the student's Oral Reading Fluency and Comprehension.
- Add the circled numbers to obtain a total score for each section.
- Record the total scores at the top of page 1.

Note: If the Comprehension score is less than 19, administer *DRA2* with a lower-level text.

Duke 8

DRA2 CONTINUUM	LEVEL 8			EARLY READER
	EMERGING	**DEVELOPING**	**INDEPENDENT**	**ADVANCED**
Reading Engagement				
Book Selection	1 Selects new texts from identified leveled sets with teacher support; uncertain about a favorite book	2 Selects new texts from identified leveled sets with moderate support; tells about favorite book in general terms	3 Selects new texts from identified leveled sets most of the time; identifies favorite book by title and tells about a particular event	4 Selects a variety of new texts that are "just right"; identifies favorite book by title and gives an overview of the book
Sustained Reading	1 Sustains independent reading for a short period of time with much encouragement	2 Sustains independent reading with moderate encouragement	3 Sustains independent reading for at least 5 minutes at a time	4 Sustains independent reading for an extended period of time
Score	2 3	4 5	6 7	8
Oral Reading Fluency				
Phrasing	1 Reads word-by-word	2 Reads word-by-word with some short phrases	3 Reads in short phrases most of the time	4 Reads in longer phrases at times
Monitoring/Self-Corrections	1 Self-corrects no miscues	2 Self-corrects at least 1 miscue and neglects to self-correct other miscues	3 Self-corrects 2 or more miscues or only makes 1 uncorrected miscue	4 Self-corrects miscues quickly or reads accurately
Problem-Solving Unknown Words	1 Stops at difficulty, relying on support to problem-solve unknown words; 3 or more words told by the teacher	2 At difficulty, initiates problem-solving of a few unknown words; 1 or 2 words told by the teacher	3 At difficulty, uses 1 or 2 cues to problem-solve unknown words	4 At difficulty, uses multiple cues to problem-solve unknown words
Accuracy	1 92% or less	2 93%	3 94%–97%	4 98%–100%
Score	4 5 6	7 8 9 10	11 12 13 14	15 16
Comprehension				
Previewing	1 Comments briefly about each event or action only when prompted or is uncertain	2 Identifies and comments briefly about each event or action with some prompting	3 Identifies and connects at least 3 key events without prompting; some relevant vocabulary	4 Identifies and connects at least 4 key events without prompting; relevant vocabulary
Retelling: Sequence of Events	1 Includes only 1 or 2 events or details (limited retelling)	2 Includes at least 3 events, generally in random order (partial retelling)	3 Includes most of the important events from the beginning, middle, and end, generally in sequence	4 Includes all important events from the beginning, middle, and end in sequence
Retelling: Characters and Details	1 Refers to characters using general pronouns; may include incorrect information	2 Refers to characters using appropriate pronouns; includes at least 1 detail; may include some misinterpretation	3 Refers to most characters by name and includes some important details	4 Refers to all characters by name and includes most of the important details
Retelling: Vocabulary	1 Uses general terms or labels; limited understanding of key words/concepts	2 Uses some language/ vocabulary from the text; some understanding of key words/concepts	3 Uses language/ vocabulary from the text; basic understanding of most key words/concepts	4 Uses important language/vocabulary from the text; good understanding of key words/concepts
Retelling: Teacher Support	1 Retells with 5 or more questions or prompts	2 Retells with 3 or 4 questions or prompts	3 Retells with 1 or 2 questions or prompts	4 Retells with no questions or prompts
Reflection	1 Gives an unrelated response, no reason for opinion, or no response	2 Gives a limited response and/or a general reason for opinion	3 Gives a specific story event/action and a relevant reason for response (e.g., personal connection)	4 Gives a response and reason that reflects higher-level thinking (e.g., synthesis/inference)
Making Connections	1 Makes an unrelated connection, relates an event in the story, or gives no response	2 Makes a connection that reflects a limited understanding of the story	3 Makes a literal connection that reflects a basic understanding of the story	4 Makes a thoughtful connection that reflects a deeper understanding of the story
Score	7 8 9 10 11 12 13	14 15 16 17 18	19 20 21 22 23 24 25	26 27 28

Choose three to five teaching/learning activities on the *DRA2* Focus for Instruction on the next page.

DRA2 FOCUS FOR INSTRUCTION FOR EARLY READERS

READING ENGAGEMENT

Book Selection

- ☐ Provide guided opportunities to select familiar stories for rereading
- ☐ Model and support how to select "just right" new texts for independent reading
- ☐ Model and discuss why readers have favorite books and authors

Sustained Reading

- ☐ Model and support the use of sustained reading time
- ☐ Create structures and routines to support buddy reading
- ☐ Create structures and routines to support reading at home

ORAL READING FLUENCY

Phrasing

- ☐ Encourage student to read in phrases during shared reading
- ☐ Show how words are grouped into phrases in big books and poetry charts
- ☐ Support rereading familiar texts to build fluency

Monitoring/Self-Corrections

- ☐ Support one-to-one matching as a means to self-monitor
- ☐ Model and teach how to use known words as a means to self-monitor
- ☐ Model and support confirming and discounting word choice using meaning, language, and visual information
- ☐ Demonstrate and teach how to read for meaning, self-correcting when a word doesn't make sense or sound right
- ☐ Model and teach how to monitor visual information, self-correcting when a word doesn't look right

Problem-Solving Unknown Words

- ☐ Model and support using beginning letter(s)/sound(s), sentence and/or story structure, as well as meaning (illustrations and background knowledge) to problem-solve unknown words
- ☐ Model and support how to take words apart (onset and rime) to problem-solve unknown words

COMPREHENSION

Previewing

- ☐ Support creating a story from the illustrations
- ☐ Model and support previewing a book before reading, during read-aloud and shared reading experiences

Retelling

- ☐ Model the retelling of familiar stories
- ☐ Model and teach the elements in a good retelling
- ☐ Demonstrate how to create and use story maps to aid retelling
- ☐ Support retelling a story in sequence
- ☐ Encourage student to use characters' names when retelling a story
- ☐ Model and support using key language/vocabulary from the text in a retelling

Reflection

- ☐ Support and reinforce student's response to books during read-aloud, and shared and guided reading experiences
- ☐ Help student identify favorite part of books
- ☐ Provide opportunities to select a favorite book, toy, TV show, etc., and tell why it is a favorite
- ☐ Demonstrate how to give reason(s) for one's opinion

Making Connections

- ☐ Model and teach how to make text-to-self connections
- ☐ Model and support how to make text-to-text connections

OTHER

_____

_____

_____

_____

_____

_____

_____

APPENDIX C

EDUCATOR QUESTIONNAIRE

EXAMINING THE PROPERTIES, USES AND INTERPRETATIONS OF FIRST GRADE READING SCREENING TOOLS

Online Consent Form

You are invited to take part in a research questionnaire about first-grade reading assessments. Your participation will require approximately 20 minutes, and is completed online at your computer. You may choose to complete the entire questionnaire in one sitting, or save your work and complete the questions any time within the next month. All eligible teachers who complete the questionnaire by December 20th will have the option to receive a $10 Amazon eGift Card in thanks for their participation! See details at the end of the survey.

There are no known risks or discomforts associated with this survey, other than the time needed to complete the questionnaire. Taking part in this study is completely voluntary. If you choose to be in the study you can withdraw at any time. Your responses will be kept strictly confidential, and digital data will be stored in secure computer files. Any report of this research that is made available to the public will not include your name or any other individual information by which you could be identified. If you have any questions about this research, you may contact Amadee Meyer at afmeyer@educ.umass.edu. If you have questions or concerns about your rights as a research participant that you would like to discuss with someone other than the investigator on this project, you may contact the UMass Amherst Human Research Protection Office (HRPO) at (413) 545-3428 or email humansubjects@ora.umass.edu. Please feel free to print a copy of this consent page to keep for your records. Clicking the "Next" button below indicates that you are 18 years of age or older, and indicates your consent to participate in this survey.

Q1.2 Do you currently work at an [Name of School District] elementary school?

- ○ Yes
- ○ No

Skip To: End of Survey If Do you currently work at an [Name of School District] elementary school? = No

Q1.3 In the past 5 years, have you assessed or worked with *first-grade students* to support their reading development?

- ○ Yes
- ○ No

Skip To: End of Survey If In the past 5 years, have you assessed or worked with first-grade students to support their readi... = No

Q1.4 Which of the following best describes your role as a first-grade educator?

- ○ Classroom teacher
- ○ Special education teacher
- ○ Reading specialist
- ○ Reading intervention teacher
- ○ Administrator
- ○ Other (please describe below) _____

Q1.5 How long have you worked in your current position?

- Years: _____

Q1.6 How many total years of teaching experience do you have?

- Years: _____

Q1.7 When considering which first-grade students are at risk of later reading failure, how much do you rely on the following sources of information?

	Not at all	Slightly	Somewhat	Very much so
Results of Informal Reading Inventories (DRA or BAS)	○	○	○	○
Results of Aimsweb Tests of Early Literacy (LNF, LSF, PSF, NWF)	○	○	○	○
Oral reading fluency (words read correctly per minute) on grade level texts	○	○	○	○
Reading curriculum (e.g. Superkids, Fundations) assessments	○	○	○	○
Your professional judgment	○	○	○	○
Other (please describe)	○	○	○	○
Other (please describe)	○	○	○	○

Q1.8 The following list includes indicators that are said to be predictive of later reading proficiency. With **first semester (September 1-February 1) first-grade** *students* in mind, please indicate the extent to which you feel each indicator is predictive of later reading success.

	not at all predictive	slightly predictive	somewhat predictive	highly predictive
oral language proficiency	○	○	○	○
vocabulary	○	○	○	○
comprehension of texts read aloud to student	○	○	○	○
knowledge of letter/sound correspondences	○	○	○	○
self regulation of behavior	○	○	○	○
sight word knowledge	○	○	○	○
decoding skills	○	○	○	○
ability to use illustrations to confirm text	○	○	○	○
self monitoring and correction	○	○	○	○
knowledge of letter names	○	○	○	○
spelling	○	○	○	○
phonological awareness	○	○	○	○
reading engagement	○	○	○	○
oral reading fluency of grade level passages	○	○	○	○

Q1.9 Please list any additional indicators that you feel are somewhat or highly predictive of later reading success.

_____

_____

Q2.1 The following questions relate to the use of **Informal Reading Inventories (IRIs)**. IRIs are individually administered assessments in which students read leveled texts and respond to comprehension questions. Examples of IRIs include the Developmental Reading Assessment (DRA) and Fountas and Pinnell Benchmark Assessment System (BAS). Please consider these assessment tools as you respond to the following questions.

Q2.2 Have you participated in professional development related to the administration or interpretation of **informal reading inventories** (such as the DRA or BAS)?
If yes, please briefly describe this training.

- Yes (please describe below)
- No

Q2.3 Have you personally administered **informal reading inventories** (e.g. DRA or BAS) to first-graders?

- Yes
- No
- Unsure

Q2.4 We are interested in understanding why teachers and schools administer **informal reading inventories**. Please answer the following:

- What information do Informal Reading Inventories provide to you as a teacher?
- What information do Informal Reading Inventories provide to the school or district?
- Other purposes?

Q2.5 Do **informal reading inventories** (e.g. DRA or BAS) provide you with information beyond what you already know from everyday observation of and interaction with your students?

- Not at all
- Slightly
- Somewhat
- Very much so

Q2.6 Consider the following purposes of assessment. According to your experience, to what extent do **informal reading inventories** (e.g. DRA or BAS) fulfill this purpose?

	Not at all	Slightly	Somewhat	Very much so
Screening: To determine which students are at risk for developing reading difficulties so that they can be provided with additional instruction	○	○	○	○
Progress Monitoring: To determine if students are making adequate growth toward meeting grade level reading outcomes or individualized goals.	○	○	○	○
Diagnosis: To inform instruction by providing in depth information about students' skills and instructional needs.	○	○	○	○
Measuring Student Outcomes: To provide an end of year evaluation of student performance and the effectiveness of the overall reading program.	○	○	○	○

Q2.7 Assessment practices lead to improved student reading achievement when they help teachers and schools answer important questions, and support data-based decision making (Coyne & Harn, 2006). Please consider the following questions related to your school's reading programming. To what extent do informal reading inventories (e.g. the DRA or BAS) help teachers and schools answer each question?

	Not at all	Slightly	Somewhat	Very much so
Which children are at risk for experiencing reading difficulties now and in the future?	○	○	○	○
Is our reading program meeting the needs of students?	○	○	○	○
Which specific beginning reading skills has a student mastered or not mastered?	○	○	○	○
Did our students improve from last year?	○	○	○	○
How can we make our reading program better?	○	○	○	○
Which students have similar instructional needs and will form an appropriate group for instruction?	○	○	○	○
Are we making progress towards our goals?	○	○	○	○
As a school have we accomplished our literacy goals?	○	○	○	○
Is intervention enabling children to make sufficient progress?	○	○	○	○
Are individual students on track for meeting end of year reading goals?	○	○	○	○
Is instruction working?	○	○	○	○
Which intervention programs are most likely to be effective based on a student's skill profile?	○	○	○	○
Which children will need additional intervention to meet reading goals?	○	○	○	○

Q2.8 Universal screening assessments are administered to all students in a classroom, school or district to identify children who are at risk of reading difficulties and who could potentially benefit from intervention. The following statements (adapted from Glover & Albers (2007)) represent considerations of evaluating universal screening assessments. Please indicate the degree to which you agree with each statement with respect to informal reading inventories (e.g. DRA or BAS) administered according to district guidelines to first-grade students for the purpose of universal screening. Please use the comments box to elaborate on responses if desired.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Unsure
The timing and frequency of administration is appropriate	○	○	○	○	○	○
The identification outcomes are relevant to the service delivery needs of students	○	○	○	○	○	○
The constructs that are being measured are relevant for determining first-graders' risk of later reading difficulties	○	○	○	○	○	○
The format and content have been validated in previous research	○	○	○	○	○	○
The assessment is contextually and developmentally appropriate for your school's population of first-graders	○	○	○	○	○	○
Alternate forms of this assessment lead to comparable results	○	○	○	○	○	○
Measurement is consistent over time	○	○	○	○	○	○
Scoring is consistent across scorers	○	○	○	○	○	○
The assessment correctly identifies most students at risk for later reading difficulty	○	○	○	○	○	○
The assessment does not falsely identify students who are not actually at risk	○	○	○	○	○	○
The assessment measures important first-grade reading skills that are indicative of later reading achievement	○	○	○	○	○	○
The assessment format and items are appropriate	○	○	○	○	○	○
The costs associated with the assessment are reasonable	○	○	○	○	○	○
The time commitment associated with the assessment is reasonable	○	○	○	○	○	○
School personnel are able to administer the assessment	○	○	○	○	○	○
Teachers appreciate the benefits associated with the assessment	○	○	○	○	○	○

Parents appreciate the benefits associated with the assessment	○	○	○	○	○	○
Students appreciate the benefits associated with the assessment	○	○	○	○	○	○
Resources are available to collect, manage, and interpret assessment data	○	○	○	○	○	○
Teachers understand the implications associated with assessment outcomes	○	○	○	○	○	○
Parents understand the implications associated with assessment outcomes	○	○	○	○	○	○
Outcomes are useful for guiding instruction/intervention	○	○	○	○	○	○
The assessment improves student outcomes	○	○	○	○	○	○

Q2.9 Please use the box below to note any additional comments regarding the use of **informal reading inventories** (e.g. DRA or BAS) in your district.

_____

_____

_____

_____

_____

Q4.1 The following questions relate to the use of **early literacy curriculum based measurement.** Early literacy CBM tools include brief, individually administered assessments in which students demonstrate foundational reading skills, and the number of correct responses in one minute is recorded. Examples of early literacy CBM include Aimsweb and DIBELS. First grade subtests include Letter Naming Fluency, Letter Sound Fluency Phoneme Segmentation Fluency, Nonsense Word Fluency and Oral Reading Fluency. Please consider these assessment tools as you respond to the following questions.

Q4.2 Have you participated in professional development related to the administration of interpretation of **early literacy curriculum based measurement** (such as Aimsweb or DIBELS)?

If yes, please briefly describe this training.

- Yes (please describe below) _____
- No

Q4.3 Have you personally administered **early literacy curriculum based measurement** (e.g. Aimsweb or DIBELS) to first-graders?

- Yes
- No
- Unsure

Q4.4 We are interested in understanding why teachers and schools administer **early literacy curriculum based measurement** (e.g. Aimsweb or DIBELS). Please answer the following:

- What information does early literacy based measurement provide to you as a teacher?
- What information does early literacy based measurement provide to the school or district?
- Other purposes?

Q4.5 Does early literacy curriculum based measurement (e. g. Aimsweb or DIBELS) provide you with information beyond what you already know from everyday observation of and interaction with your students?

- Not at all
- Slightly
- Somewhat
- Very much so

Q4.6 Consider the following purposes of assessment. According to your experience, to what extent does **early literacy curriculum based measurement** (e.g. Aimsweb or DIBELS) fulfill this purpose?

	Not at all	Slightly	Somewhat	Very much so
Screening: To determine which students are at risk for developing reading difficulties so that they can be provided with additional instruction	○	○	○	○
Progress monitoring: To determine if students are making adequate growth toward meeting grade level reading outcomes or individualized goals.	○	○	○	○
Diagnosis: To inform instruction by providing in depth information about students' skills and instructional needs.	○	○	○	○
Measuring student outcomes: To provide an end of year evaluation of student performance and the effectiveness of the overall reading program.	○	○	○	○

Q4.7 Assessment practices lead to improved student reading achievement when they help teachers and schools answer important questions, and support data-based decision making (Coyne & Harn, 2006). Please consider the following questions related to your school's reading programming. To what extent does early literacy curriculum based measurement (e. g. Aimsweb or DIBELS) help teachers and schools answer each question?

	Not at all	Slightly	Somewhat	Very much so
Which children are at risk for experiencing reading difficulties now and in the future?	○	○	○	○
Is our reading program meeting the needs of students?	○	○	○	○
Which specific beginning reading skills has a student mastered or not mastered?	○	○	○	○
Did our students improve from last year?	○	○	○	○
How can we make our reading program better?	○	○	○	○
Which students have similar instructional needs and will form an appropriate group for instruction?	○	○	○	○
Are we making progress towards our goals?	○	○	○	○
As a school have we accomplished our literacy goals?	○	○	○	○
Is intervention enabling children to make sufficient progress?	○	○	○	○
Are individual students on track for meeting end of year reading goals?	○	○	○	○
Is instruction working?	○	○	○	○
Which intervention programs are most likely to be effective based on a student's skill profile?	○	○	○	○
Which children will need additional intervention to meet reading goals?	○	○	○	○

Q4.8 Universal screening assessments are administered to all students in a classroom, school or district to identify children who are at risk of reading difficulties and who could potentially benefit from intervention. The following statements (adapted from Glover & Albers (2007)) represent considerations of evaluating universal screening assessments. Please indicate the degree to which you agree with each statement with respect to Early Literacy Curriculum Based Measurement (e.g. Aimsweb or DIBELS) administered according to district guidelines to first-grade students for the purpose of universal screening. Please use the comments box to elaborate on responses if desired.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Unsure
The timing and frequency of administration is appropriate	○	○	○	○	○	○
The identification outcomes are relevant to the service delivery needs of students	○	○	○	○	○	○
The constructs that are being measured are relevant for determining first-graders' risk of later reading difficulties	○	○	○	○	○	○
The format and content have been validated in previous research	○	○	○	○	○	○
The assessment is contextually and developmentally appropriate for your school's population of first-graders	○	○	○	○	○	○
Alternate forms of this assessment lead to comparable results	○	○	○	○	○	○
Measurement is consistent over time	○	○	○	○	○	○
Scoring is consistent across scorers	○	○	○	○	○	○
The assessment correctly identifies most students at risk for later reading difficulty	○	○	○	○	○	○
The assessment does not falsely identify students who are not actually at risk	○	○	○	○	○	○
The assessment measures important first-grade reading skills that are indicative of later reading achievement	○	○	○	○	○	○
The assessment format and items are appropriate	○	○	○	○	○	○
The costs associated with the assessment are reasonable	○	○	○	○	○	○
The time commitment associated with the assessment is reasonable	○	○	○	○	○	○
School personnel are able to administer the assessment	○	○	○	○	○	○
Teachers appreciate the benefits associated with the assessment	○	○	○	○	○	○

Parents appreciate the benefits associated with the assessment	○	○	○	○	○	○
Students appreciate the benefits associated with the assessment	○	○	○	○	○	○
Resources are available to collect, manage, and interpret assessment data	○	○	○	○	○	○
Teachers understand the implications associated with assessment outcomes	○	○	○	○	○	○
Parents understand the implications associated with assessment outcomes	○	○	○	○	○	○
Outcomes are useful for guiding instruction/intervention	○	○	○	○	○	○
The assessment improves student outcomes	○	○	○	○	○	○

Q4.9 Please use the box below to note any additional comments regarding the use of **early literacy curriculum based measurement (e. g. Aimsweb or DIBELS)** in your district.

_____

_____

_____

_____

_____

Q56 For the purpose of ***screening*** (determining which students are at risk for developing reading difficulties so that they can be provided with additional instruction), how valuable is each of the following sources of **fall** 1st grade data?

	Very valuable	Somewhat valuable	Slightly valuable	Not at all valuable	Unsure
Fall Letter Naming Fluency	○	○	○	○	○
Fall Letter Sound Fluency	○	○	○	○	○
Fall Phoneme Segmentation Fluency	○	○	○	○	○
Fall Nonsense Word Fluency	○	○	○	○	○
Fall BAS or DRA level	○	○	○	○	○
Fall Teacher Judgement	○	○	○	○	○

Q57 For the purpose of ***screening*** (determining which students are at risk for developing reading difficulties so that they can be provided with additional instruction), how valuable is each of the following sources of **winter** 1st grade data?

	Very valuable	Somewhat valuable	Slightly valuable	Not at all valuable	Unsure
Winter Phoneme Segmentation Fluency	○	○	○	○	○
Winter Nonsense Word Fluency	○	○	○	○	○
Winter Oral Reading Fluency	○	○	○	○	○
Winter BAS or DRA level	○	○	○	○	○
Winter Teacher Judgement	○	○	○	○	○

APPENDIX D

QUESTIONNAIRE RESULTS

Which of the following best describes your role as a first-grade educator?

Answer	%	Count
Classroom teacher	16.7%	2
Special education teacher	25.0%	3
Reading specialist	16.7%	2
Reading intervention teacher	33.3%	4
Administrator	0.0%	0
Other (Specialized Instructional Coach)	8.3%	1
Total	100%	12

How long have you worked in your current position?
Average = 9.75 years

How many total years of teaching experience do you have?
Average = 19.5 years

When considering which first-grade students are at risk of later reading failure, how much do you rely on the following sources of information?

Sources of information	Not at all	Slightly	Somewhat	Very much so	Agreement
Your professional judgment	0.0%	0.0%	25.0%	75.0%	2.75
Results of Informal Reading Inventories	0.0%	8.3%	33.3%	58.3%	2.5
Results of Aimsweb Tests of Early Literacy	0.0%	0.0%	50.0%	50.0%	2.5
Oral reading fluency on grade level texts	0.0%	8.3%	75.0%	16.7%	2.1
Reading curriculum assessments	8.3%	41.7%	41.7%	8.3%	1.5

Other sources of information that educators rely on somewhat or very much so:
"Phonological Awareness"
"Oral Reading by mid-year, not in Sept. on the Aimsweb"
"rapid naming"
"Data from daily lessons such as reading word lists, etc."
"Phonemic Awareness Diagnostic: PAST"
"prior preparation for literacy"
"Individual reading conferences"
"peer consultation"
"Multisensory"
"QPS to screen phonics"
"reading specialist"

The following list includes indicators that are said to be predictive of later reading proficiency. With first semester (September 1-February 1) first-grade students in mind, please indicate the extent to which you feel each indicator is predictive of later reading success.

Indicator	not at all predictive	slightly predictive	somewhat predictive	highly predictive	Agreement
knowledge of letter/sound correspondences	0.0%	0.0%	8.3%	91.7%	2.9
decoding skills	0.0%	0.0%	33.3%	66.7%	2.7
phonological awareness	0.0%	0.0%	33.3%	66.7%	2.7
oral language proficiency	0.0%	0.0%	50.0%	50.0%	2.5
knowledge of letter names	8.3%	0.0%	25.0%	66.7%	2.5
comprehension of texts read aloud to student	0.0%	8.3%	41.7%	50.0%	2.4
vocabulary	0.0%	8.3%	58.3%	33.3%	2.3
self monitoring and correction	0.0%	16.7%	33.3%	50.0%	2.3
reading engagement	0.0%	8.3%	50.0%	41.7%	2.3
oral reading fluency of grade level passages	0.0%	25.0%	50.0%	25.0%	2.0
sight word knowledge	8.3%	25.0%	50.0%	16.7%	1.8
spelling	0.0%	25.0%	75.0%	0.0%	1.8
ability to use illustrations to confirm text	8.3%	25.0%	58.3%	8.3%	1.7
self regulation of behavior	16.7%	25.0%	50.0%	8.3%	1.5

Additional indicators that are somewhat or highly predictive:

"Students must feel they are in a safe environment to make mistakes. If a student had trauma in life, they may not be available for learning"
"Students who don't have the opportunity to explore books, book handling skills"
"Ability to write 10 or more sight words correctly"
"working memory"
"The student's ability to retell stories in their own words without prompts or pictures is highly indicative of reading success"
"Home support is very important. Being read to and being able to read to a parent/caretaker. Access to books and writing materials."
"Knowledge of story structure, experience being read aloud to "
"Ability to convert language to mental imagery."

Informal Reading Inventories

Have you participated in professional development related to the administration or interpretation of informal reading inventories?

Yes	90.9%
No	9.1%

If yes, please briefly describe this training:
"BAS- in house, small group. No formal training"
"Explicit explanation of how to administer, practice administering, modeling of how to administer"
"Extensive PD on using the QRI and the Burns and Roe (IRI), when at a previous district"
"4 hour Training on DRA with follow up discussions/trouble shooting with groups of staff.
"No formal training on BAS. Read manual, applied DRA training to this tool."
"I developed PD for the BAS"
"Years ago we had formal training in how to administer the DRA and due running records. We were given a less in depth training for the BAS but because it is similar to the DRA, it was not as important, but less experienced teachers were hoping for more training."
"I was trained to use both the DRA and BAS. Emphasis was on both administering the assessment and interpreting results."
"I have trained teachers in how to administer the BAS."
"Yes - 3-credit course on reading assessment focusing on the BAS through the Collaborative Educational Services"
"Training in the BAS was provided during the fall."

Have you personally administered informal reading inventories to first-graders?

Yes	100.00%
No	0.00%
Unsure	0.00%

We are interested in understanding why teachers and schools administer early literacy curriculum based measurement. Please answer the following:

What information do Informal Reading Inventories provide to you as a teacher?
"Targeted instruction for reading groups"
"understanding of instructional reading level, chance to observe oral reading behaviors as a way to identify next steps for instruction, understanding of various areas of comprehension"
"Lots - the Burns and Roe and QRI provide data around RC, vocabulary, accuracy, and fluency! All support teachers to monitor growth and ability to generalize skills in connected, uncontrolled text."
"I find that error analysis of student performance to have the most significant impact on my instruction. I do find that the tool offers a general sense of growth by a student over time."
"concept of print, print awareness, sight words"
"IRI's inform me as to where my students are in their literacy development and inform my daily teaching for skill and book groups."
"They let me know what level of texts my students are capable of reading with accuracy and comprehension. I use this information to make decisions about specific skills to teach as well as what books to use for instruction."
"Provides an accurate reading level which is crucial for instruction. Provides an opportunity to analyze a student's reading to see what strategies they are using to decode. Also tests a student's comprehension on an oral reading passage and shows if a student is self monitoring their reading."
"Allow us to create reading groups of children with similar reading abilities; allow us to design targeted instruction for students with similar needs"
"A form of performance assessment with some level of standardization."
"The informal reading inventories are useful as a gauge to measure student benchmarks."

What information do Informal Reading Inventories provide to the school or district

"Support that is needed in the classroom environment"
"instructional reading levels of texts, way to monitor progress that aligns with the actual classroom instruction"
"It's depends on how they are used. In ARPS, they are used as F/W/S assessments, and in some cases in between to probe."
"General information about whether a child is progressing in their ability to read increasingly complex words and sentences. On a large scale this can be used as a screening tool to help us determine students who require a more in depth assessment and intervention."
"According to F & P, which students are "Below Grade level"
"IRI's provide us with information in parent conferences and evaluative meetings about benchmarks that each student may have, or not have achieved. I give my BAS scores to the literacy coach three times a year and that data is recorded, so that student achievement can be monitored."
"Not sure"
"Shows progress that students are making reading authentic books/texts instead of just looking at decodable words or just fluency. Gives a bigger picture of where students are in terms of literacy learning."
"Allows data analysis of how students meet grade-level standards across the building and/or district"
"How students perform according to a certain standard."
"BAS and AIMSWEB assessments."

Other purposes?

"State results"
"Ability to interact with authentic text"
"Allows for measurement of an individual reader's progress over time"
"Ongoing assessment of ability and growth."

Do informal reading inventories provide you with information beyond what you already know from everyday observation of and interaction with your students?

Not at all	0.00%
Slightly	36.4%
Somewhat	54.6%
Very much so	9.1%

Consider the following purposes of assessment. According to your experience, to what extent do informal reading inventories fulfill this purpose?

Purpose	Not at all	Slightly	Somewhat	Very much so	Agreement
Screening	0.0%	27.3%	18.2%	54.6%	2.3
Progress Monitoring	0.00%	27.3%	27.3%	45.5%	2.2
Measuring Student Outcomes	0.00%	27.3%	27.3%	45.5%	2.2
Diagnosis	0.0%	45.5%	18.2%	36.4%	1.9

Please consider the following questions related to your school's reading programming. To what extent do informal reading inventories help teachers and schools answer each question?

Question	Not at all	Slightly	Somewhat	Very much so	Agreement	
Which children are at risk for experiencing reading difficulties now and in the future?	0.0%	27.3%	36.4%	36.4%	2.1	Screening 2.1
Which children will need additional intervention to meet reading goals	0.0%	36.4%	18.2%	45.5%	2.1	
Is intervention enabling children to make sufficient progress?	9.1%	27.3%	18.2%	45.5%	2.0	Progress Monitoring 2.1
Are individual students on track for meeting end of year reading goals?	0.0%	18.2%	45.5%	36.4%	2.2	
Is instruction working?	0.0%	27.3%	36.4%	36.4%	2.1	
Is our reading program meeting the needs of students?	0.0%	36.4%	45.5%	18.2%	1.8	Measuring Outcomes 1.9
Did our students improve from last year?	0.0%	18.2%	45.5%	36.4%	2.2	
How can we make our reading program better?	0.0%	54.6%	27.3%	18.2%	1.6	
Are we making progress towards our goals?	0.0%	27.3%	45.5%	27.3%	2.0	
As a school have we accomplished our literacy goals?	0.0%	27.3%	72.7%	0.0%	1.7	
Which specific beginning reading skills has a student mastered or not mastered?	0.0%	45.5%	18.2%	36.4%	1.9	Diagnosis 1.8
Which students have similar instructional needs and will form an appropriate group for instruction?	0.0%	36.4%	9.1%	54.6%	2.2	
Which intervention programs are most likely to be effective based on a student's skill profile?	9.1%	54.6%	18.2%	18.2%	1.5	

Please indicate the degree to which you agree with each statement with respect to informal reading inventories administered according to district guidelines to first-grade students for the purpose of universal screening.

Question	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Unsure		Agree-ment
Timing and frequency is appropriate	18.2%	27.3%	27.3%	18.2%	0.0%	9.1%	2.5	
Constructs measured are relevant	9.1%	63.6%	0.0%	27.3%	0.0%	0.0%	2.5	
Format and content have been validated by research	9.1%	63.6%	9.1%	9.1%	0.0%	9.1%	2.7	Appropriateness for intended use 2.6
Contextually and developmentally appropriate	18.2%	36.4%	9.1%	36.4%	0.0%	0.0%	2.4	
Measures skills indicative of later reading success	9.1%	54.6%	18.2%	18.2%	0.0%	0.0%	2.6	
Format and items are appropriate	18.2%	36.4%	27.3%	18.2%	0.0%	0.0%	2.6	
Alternate forms lead to comparable results	9.1%	36.4%	18.2%	9.1%	0.0%	27.3%	2.7	
Measurement is consistent over time	9.1%	45.5%	9.1%	27.3%	0.0%	9.1%	2.4	Technical Adequacy 2.3
Scoring consistent across scorers	0.0%	27.3%	9.1%	54.6%	0.0%	9.1%	1.7	
Correctly identifies most students at risk	10.0%	40.0%	40.0%	10.0%	0.0%	0.0%	2.5	
Does not falsely identify students not at risk	9.1%	45.5%	18.2%	27.3%	0.0%	0.0%	2.4	
Identification outcomes relevant to service delivery	27.3%	36.4%	18.2%	9.1%	0.0%	9.1%	3.1	
Costs associated with the assessment are reasonable	9.1%	36.4%	27.3%	9.1%	0.0%	18.2%	2.2	
Time commitment is reasonable	9.1%	36.4%	27.3%	18.2%	9.1%	0.0%	2.2	
School personnel are able to administer	9.1%	63.6%	18.2%	9.1%	0.0%	0.0%	2.7	
Teachers appreciate the benefits	9.1%	63.6%	0.0%	9.1%	9.1%	9.1%	2.6	
Parents appreciate the benefits	0.0%	36.4%	27.3%	9.1%	9.1%	18.2%	2.1	Usability 2.4
Students appreciate the benefits	0.0%	18.2%	36.4%	0.0%	18.2%	27.3%	1.8	
Resources available to collect/manage/interpret data	0.0%	63.6%	18.2%	9.1%	0.0%	9.1%	2.6	
Teachers understand the implications of outcomes	9.1%	54.6%	9.1%	27.3%	0.0%	0.0%	2.5	
Parents understand the implications of outcomes	0.0%	18.2%	27.3%	18.2%	9.1%	27.3%	1.8	
Outcomes guide instruction/intervention	27.3%	45.5%	27.3%	0.0%	0.0%	0.0%	3.0	
Improves student outcomes	10.0%	50.0%	30.0%	10.0%	0.0%	0.0%	2.6	

Additional Comments:

The timing and frequency of administration is appropriate
"I feel BAS should be administered 2x a year (fall & winter) vs. 3x yr. (including spring)"
"It's 3 times a year, with some probes given in between for students receiving intervention. They drive placement for intervention groups"
"Given the tools - with not a lot of text options at each level - it can only be used a few times a year to really be reliable"
"With some students, I assess more frequently"
"Not sure that it makes sense to assess students at end of year and then again at beginning of year. Higher achieving students are usually at the same level if not higher and lower achieving and intervention students typically lose ground over the summer so much of BOY assessments is predictable if student has been in the district the previous year"

The identification outcomes are relevant to the service delivery needs of students
"Helps to plan for targeted skill instruction"
"Sometimes - it depends on the practitioner"
"Many students cannot demonstrate growth because they cannot access the earliest passage contain a wide variety of phonetic concepts"

The constructs that are being measured are relevant for determining first-graders' risk of later reading difficulties
"Not necessarily..."
"The beginning passages assume knowledge of a variety of syllable types and a variety of long and short vowel sounds. They also contain some multisyllabic words. Many students are unable to access these reading passages and would be better served monitoring growth on passages that contain decoding skills that are typically taught"

The format and content have been validated in previous research
Just the authors' research....

The assessment is contextually and developmentally appropriate for your school's population of first-graders
"Not for all bilingual learners or students with limited opportunities"

Alternate forms of this assessment lead to comparable results
"Fiction v. non-fiction?"
"alternative forms of text are few for each level"

Measurement is consistent over time
"This tool allows for some level of subjectivity by assessors"

Scoring is consistent across scorers
"It can be highly subjective"
"Not sure this is the case"

The assessment does not incorrectly identify students who are not at risk
"At early levels it may"

The assessment measures important first-grade reading skills that are indicative of later reading achievement
"Does not include decodable text, which is the backbone of the first-grade curriculum at this school. Sometimes"

The assessment format and items are appropriate
"Text structures do not always match what's been taught in the classroom"

"Reading connected text and demonstrating comprehension is one part of analyzing a child's skills"

The costs associated with the assessment are reasonable
"The assessment takes a long time to administer. However, I do think it is important that reading of connected text is part of an assessment menu to allow for analysis of generalization of discrete skills and a student's use of context cues"

The time commitment associated with the assessment is reasonable
"The time spent is necessary but takes a huge amount of time each year"

School personnel are able to administer the assessment
"We would like to see the classroom teachers receive more help with this"

Teachers appreciate the benefits associated with the assessment
"Teachers across the district rely heavily on these scores"

Parents appreciate the benefits associated with the assessment
"When given a chart that explains what the levels mean"

Resources are available to collect, manage, and interpret assessment data
"Literacy specialists in all buildings"

Teachers understand the implications associated with assessment outcomes
"I am not sure but my guess is that teachers have a wide continuum of ability in understanding the implications of the data and how to use the data gathered to instruct"

Outcomes are useful for guiding instruction/intervention
"They can be - depends on the practitioner"
"Data is more useful to more skilled teachers is my guess"

Additional comments regarding the use of informal reading inventories:
"A more formal training should be had with New Hires"
"I answered these questions with respect to the DRA/BAS, not the Burns and Roe/QRI. From my perspective, there are notable differences between the two sets of tools"
"My understanding from coursework is that the BAS is meant to be used no more than twice a year (beginning/end) to assess progress over a year. This is due to the limited number of titles available at each reading level (2). I'm concerned that we use the BAS three times a year, diluting the quantity of books available. It also requires a large time commitment mid-year when little instruction can take place. I think it would be beneficial to find a less time-consuming method of determining students' reading progress mid-year"

Early Literacy Curriculum Based Measurement

Have you participated in professional development related to the administration of interpretation of early literacy curriculum based measurement?

Yes	72.73%
No	27.27%

If yes, please briefly describe this training."

"In-house, informal training"
"Training of Aimsweb from district reading specialist"
"I participated in explicit instruction on administration of DIBELS. Follow up work was done by trainers to check in on our administration practices and questions"
"PD one day"
"We were trained in Aimsweb administration when the district began using it about 5 years ago"
"Yes - AIMSweb training offered by the company to district employees"
"Aimsweb training took place this fall"

Have you personally administered early literacy curriculum based measurement to first-graders?

Yes	81.82%
No	18.18%
Unsure	0.00%

We are interested in understanding why teachers and schools administer early literacy curriculum based measurement. Please answer the following:

What information does early literacy based measurement provide to you as a teacher?

"Instruction"
"normed results"
"Diagnostic information to drive instruction"
"These CBM's provide information that allows for identification of students who are at risk of reading difficulties due to phonological processing. The screeners provide information on phonological awareness, RAN, blending and segmenting, and connected text reading skills."
"students at risk, student growth towards norms, overall outcomes of literacy instruction on student growth"
"We can see how the students perform on particular individual reading skills, as opposed to whole reading tasks"
"As I understand it, Aimsweb is a screener used to sort out students who might need intervention"
"Shows how quickly a student can process which does not aide in early literacy instruction"
"students' ability to name letters and letter sounds in a timed setting"
"performance assessment"

What information does early literacy based measurement provide to the school or district?

"Support"
"normed results"
"same (diagnostic information to drive instruction); and allows for data to drive intervention groupings"
"Critical information allowing us to identify kids at risk early and plan for effective intervention to address phonological awareness and decoding/encoding skill development"
"trends in data; growth, skill deficits of population, ELL norms"
"Student performance percentiles and comparisons from month to month within a grade level and year to year as class groups change"
"I believe they may use it to measure if the phonetic programs are working"
"rank ordering of students based on ability to complete subtests"
"school district performance"

Other purposes?
"State Results"
"Title 1 funding :)"
"Helps guide instruction and provides progress monitoring data"
"used to determine students who qualify for intervention, for progress monitoring of students in intervention (sometimes SE as well)"
"way to measure student progress/growth"

Does early literacy curriculum based measurement provide you with information beyond what you already know from everyday observation of and interaction with your students?

Not at all	18.18%
Slightly	0.00%
Somewhat	54.55%
Very much so	27.27%

Consider the following purposes of assessment. According to your experience, to what extent does early literacy curriculum based measurement fulfill this purpose?

Purpose	Not at all	Slightly	Somewhat	Very much so	Agreement
Screening	0.0%	18.2%	27.3%	54.6%	2.4
Progress Monitoring	0.0%	9.1%	63.6%	27.3%	2.2
Measuring Student Outcomes	0.0%	45.5%	45.5%	9.1%	1.6
Diagnosis	18.2%	45.5%	27.3%	9.1%	1.3

Please consider the following questions related to your school's reading programming. To what extent does early literacy curriculum based measurement help teachers and schools answer each question?"

Question	Not at all	Slightly	Somewhat	Very much so	Agreement	
Which children are at risk for experiencing reading difficulties now and in the future?	0.0%	27.3%	36.4%	36.4%	2.1	Screening 2.2
Which children will need additional intervention to meet reading goals	0.0%	9.1%	54.6%	36.4%	2.3	
Is intervention enabling children to make sufficient progress?	0.0%	36.4%	54.6%	9.1%	2.1	Progress Monitoring 1.9
Are individual students on track for meeting end of year reading goals?	0.0%	18.2%	54.6%	27.3%	1.9	
Is instruction working?	0.0%	27.3%	54.6%	18.2%	1.7	
Is our reading program meeting the needs of students?	0.0%	54.6%	36.4%	9.1%	1.8	Measuring Outcomes 1.7
Did our students improve from last year?	0.0%	27.3%	54.6%	18.2%	2.2	
How can we make our reading program better?	18.2%	45.5%	18.2%	18.2%	1.6	
Are we making progress towards our goals?	9.1%	18.2%	45.5%	27.3%	2.0	
As a school have we accomplished our literacy goals?	9.1%	36.4%	45.5%	9.1%	1.7	
Which specific beginning reading skills has a student mastered or not mastered?	0.0%	36.4%	54.6%	9.1%	1.9	Diagnosis 1.7
Which students have similar instructional needs and will form an appropriate group for instruction?	9.1%	27.3%	36.4%	27.3%	2.2	
Which intervention programs are most likely to be effective based on a student's skill profile?	9.1%	18.2%	72.7%	0.0%	1.5	

Please indicate the degree to which you agree with each statement with respect to early literacy CBM administered according to district guidelines to first-grade students for the purpose of universal screening.

Question	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Unsure	Agreement	
Timing and frequency is appropriate	18.2%	54.6%	18.2%	9.1%	0.0%	0.0%	3.0	Appropriateness for intended use 2.7
Constructs measured are relevant	20.0%	50.0%	30.0%	0.0%	0.0%	0.0%	2.9	
Format and content have been validated by research	18.2%	36.4%	18.2%	0.0%	0.0%	27.3%	3.0	
Contextually and developmentally appropriate	18.2%	27.3%	27.3%	18.2%	9.1%	0.0%	2.3	
Measures skills indicative of later reading success	18.2%	54.6%	9.1%	18.2%	0.0%	0.0%	2.7	
Format and items are appropriate	18.2%	36.4%	18.2%	27.3%	0.0%	0.0%	2.5	
Alternate forms lead to comparable results	18.2%	27.3%	18.2%	0.0%	0.0%	36.4%	3.0	Technical Adequacy 2.5
Measurement is consistent over time	18.2%	54.6%	9.1%	18.2%	0.0%	0.0%	2.7	
Scoring consistent across scorers	9.1%	72.7%	18.2%	0.0%	0.0%	0.0%	2.8	
Correctly identifies most students at risk	0.0%	63.6%	18.2%	18.2%	0.0%	0.0%	2.4	
Does not falsely identify students not at risk	0.0%	9.1%	27.3%	54.6%	9.1%	0.0%	1.4	
Identification outcomes relevant to service delivery	9.1%	63.6%	9.1%	9.1%	0.0%	9.1%	2.8	Usability 2.2
Costs associated with the assessment are reasonable	18.2%	18.2%	9.1%	9.1%	0.0%	45.5%	2.8	
Time commitment is reasonable	27.3%	36.4%	0.0%	18.2%	18.2%	0.0%	2.4	
School personnel are able to administer	27.3%	45.5%	9.1%	18.2%	0.0%	0.0%	2.8	
Teachers appreciate the benefits	9.1%	18.2%	18.2%	27.3%	9.1%	18.2%	1.9	
Parents appreciate the benefits	0.0%	9.1%	27.3%	27.3%	9.1%	27.3%	1.5	
Students appreciate the benefits	0.0%	0.0%	9.1%	45.5%	18.2%	27.3%	0.9	
Resources available to collect/manage/interpret data	9.1%	72.7%	9.1%	0.0%	0.0%	9.1%	3.0	
Teachers understand the implications of outcomes	9.1%	63.6%	9.1%	18.2%	0.0%	0.0%	2.6	
Parents understand the implications of outcomes	0.0%	9.1%	27.3%	27.3%	9.1%	27.3%	1.5	
Outcomes guide instruction/intervention	18.2%	36.4%	18.2%	18.2%	9.1%	0.0%	2.4	
Improves student outcomes	18.2%	18.2%	27.3%	18.2%	9.1%	9.1%	2.2	

Additional Comments:

The timing and frequency of administration is appropriate
"Benchmarking is appropriate. Monitoring every two weeks does not seems as informative as other monitoring measures that directly align to the specific targeted reading skill for each student"
"I think the data is useful for identifying at risk students, but the data meetings hinder our actual start date of skill and book groups"

The identification outcomes are relevant to the service delivery needs of students
"They can be"
"I use this data in my own instruction and progress monitoring but I am not clear on how it is used by others in the district"

The constructs that are being measured are relevant for determining first-graders' risk of later reading difficulties
"Yes - NWF probes are quite helpful when predicting future decoding skills"
"Some of the skill tests are helpful while others are not"

The format and content have been validated in previous research
"By the authors' research..."

The assessment is contextually and developmentally appropriate for your school's population of first-graders
"No real context given"

Measurement is consistent over time
"Depends on the practitioners"

Scoring is consistent across scorers
"I believe this to be true when explicit instruction on the tool has been provided to all teachers"

The assessment does not incorrectly identify students who are not at risk
"Some students may not perform consistent with their skills. Given that this tool is a screener or progress monitoring tool, other data is always available to analyze when a child's performance is a surprise"

The assessment measures important first-grade reading skills that are indicative of later reading achievement
"It does, but the assessment measures that are used at this school only measure a small part of a student's reading profile (nonsense word reading). It does not seem to closely align with guided reading at a student's instructional level"
"These CBM tools provide critical information about the most basic building blocks of reading"

The costs associated with the assessment are reasonable
"District-level adoption"
"The testing time interrupts direct services to students several times a year for a significant period of time"

School personnel are able to administer the assessment
"Aims web- Reading interventionist; Bas- all teachers and RI"
"The Intervention team is responsible for testing the entire school. Very time consuming and intervention groups have to be cancelled for at least a week if not more"

Teachers appreciate the benefits associated with the assessment
"Not always – "
"I get the sense that some people either do not believe these measures are valid or they are unclear about the connection between these skills and student outcomes (not clear about research on development of basic reading skills)"

Parents appreciate the benefits associated with the assessment
"I am not sure parents generally understand these measures"

Students appreciate the benefits associated with the assessment
"Depends on how this information is used and shared. My students graph their performance on ORF every 2 weeks to assess and celebrate growth"

Resources are available to collect, manage, and interpret assessment data
"There is a literacy specialist in each building"

Teachers understand the implications associated with assessment outcomes
"I do not think enough people understand the implications"

Outcomes are useful for guiding instruction/intervention
"Useful for grouping and PM"

Please use the box below to note any additional comments regarding the use of early literacy curriculum based measurement) in your district.
"The timed nature of these tests distorts the ability to measure a student's ability vs. ability to do timed tests. Oral reading passages are not written to grade-level standards (much harder.) ELL students are not accommodated in any way"

For the purpose of screening (determining which students are at risk for developing reading difficulties so that they can be provided with additional instruction), how valuable is each of the following sources of fall 1st grade data?

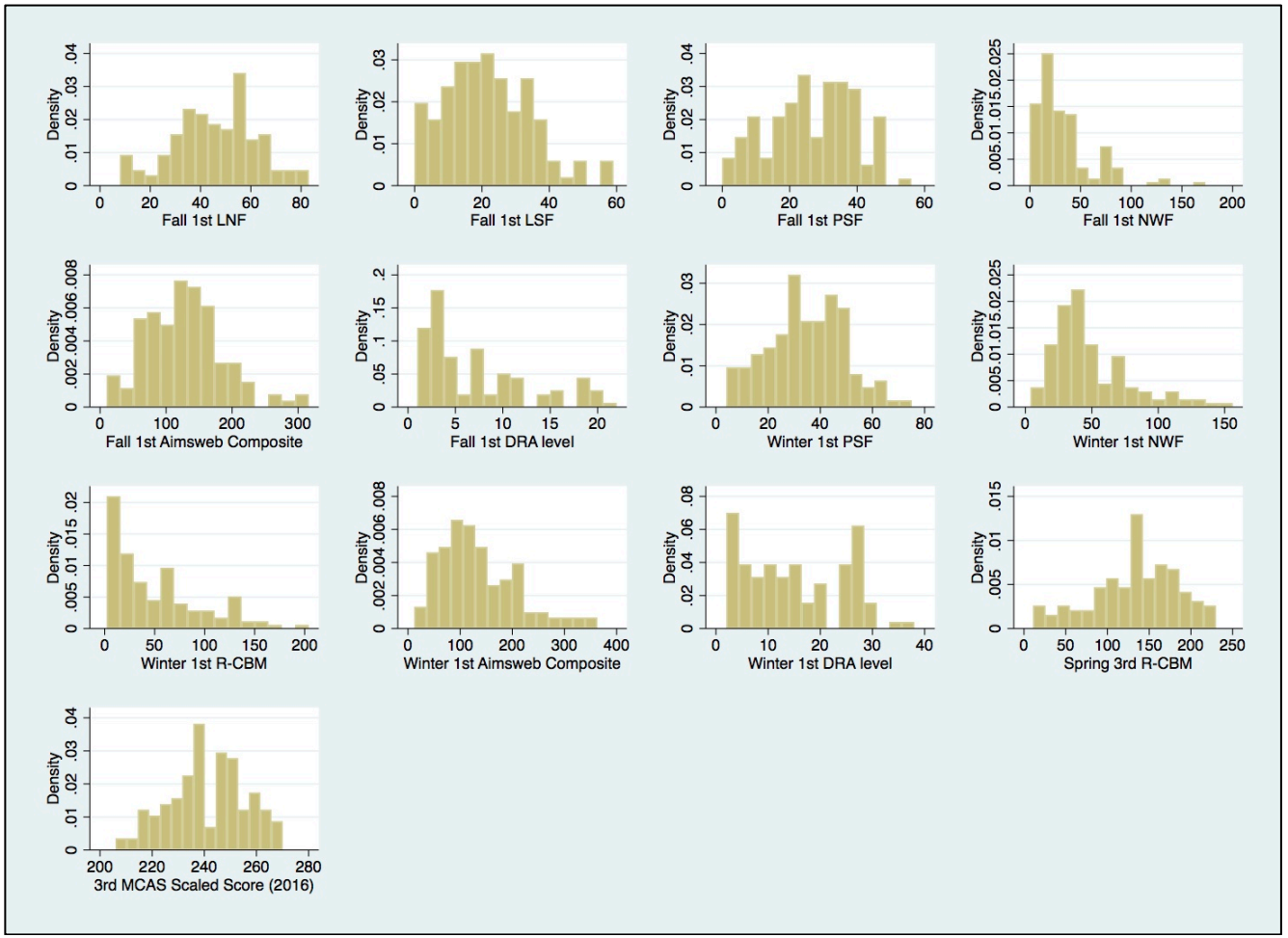
Question	Very valuable	Somewhat valuable	Slightly valuable	Not at all valuable	Unsure	Agreement
Fall LNF	72.7%	18.2%	0.0%	9.1%	0.0%	2.5
Fall LSF	63.6%	36.4%	0.0%	0.0%	0.0%	2.6
Fall PSF	63.6%	18.2%	0.0%	9.1%	9.1%	2.5
Fall NWF	27.3%	36.4%	18.2%	9.1%	9.1%	1.9
Fall BAS or DRA level	45.5%	27.3%	27.3%	0.0%	0.0%	2.2
Fall Teacher Judgement	36.4%	36.4%	18.2%	0.0%	9.1%	2.2

For the purpose of screening (determining which students are at risk for developing reading difficulties so that they can be provided with additional instruction), how valuable is each of the following sources of winter 1st grade data?

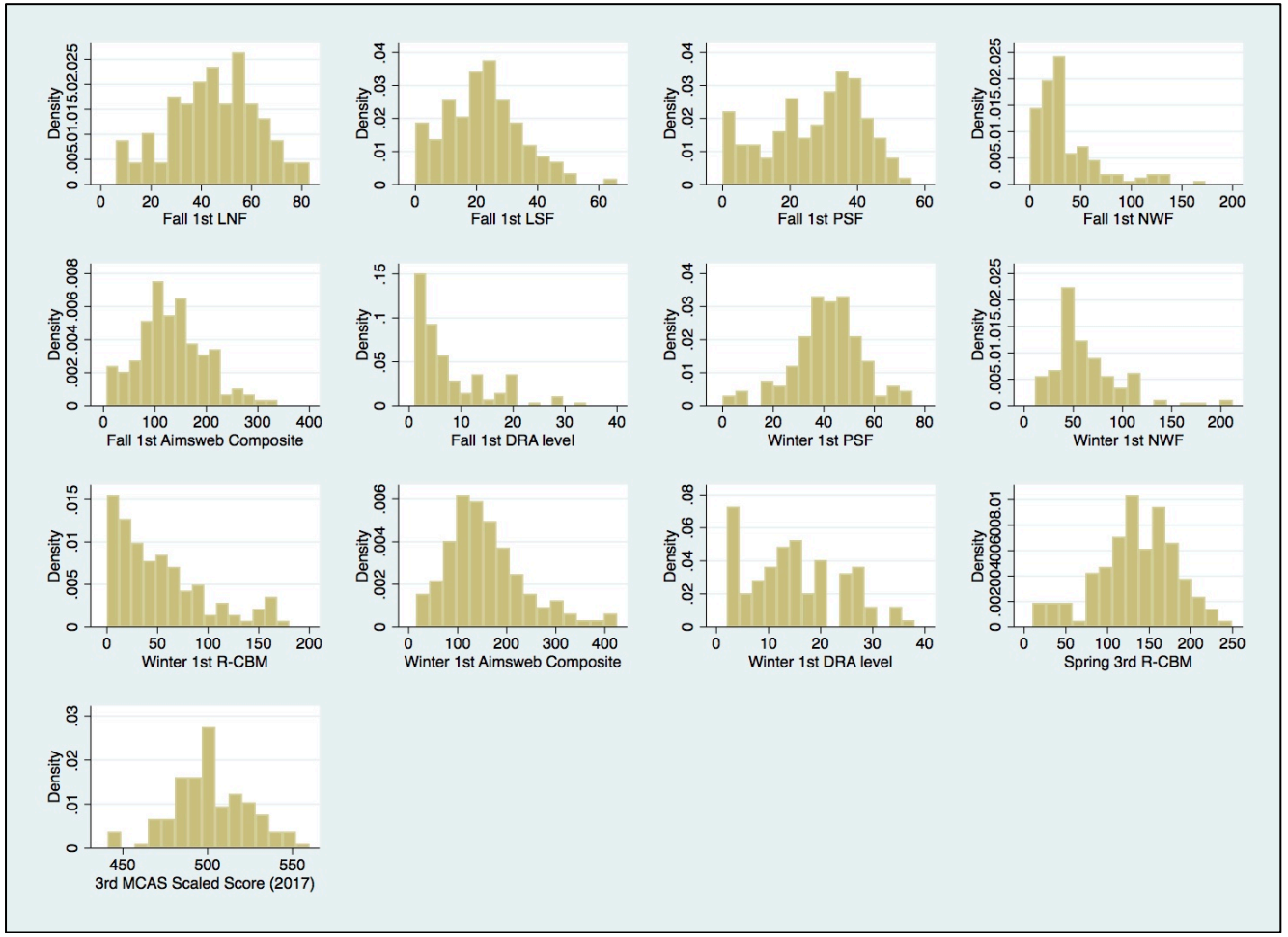
Question	Very valuable	Somewhat valuable	Slightly valuable	Not at all valuable	Unsure	Agreement
Winter PSF	72.7%	18.2%	0.0%	9.1%	0.0%	2.5
Winter NWF	54.6%	36.4%	9.1%	0.0%	0.0%	2.5
Winter ORF	36.4%	54.6%	9.1%	0.0%	0.0%	2.3
Winter BAS or DRA level	54.6%	18.2%	27.3%	0.0%	0.0%	2.3
Winter Teacher Judgement	63.6%	27.3%	0.0%	0.0%	9.1%	2.7

APPENDIX E

HISTOGRAMS OF VARIABLES



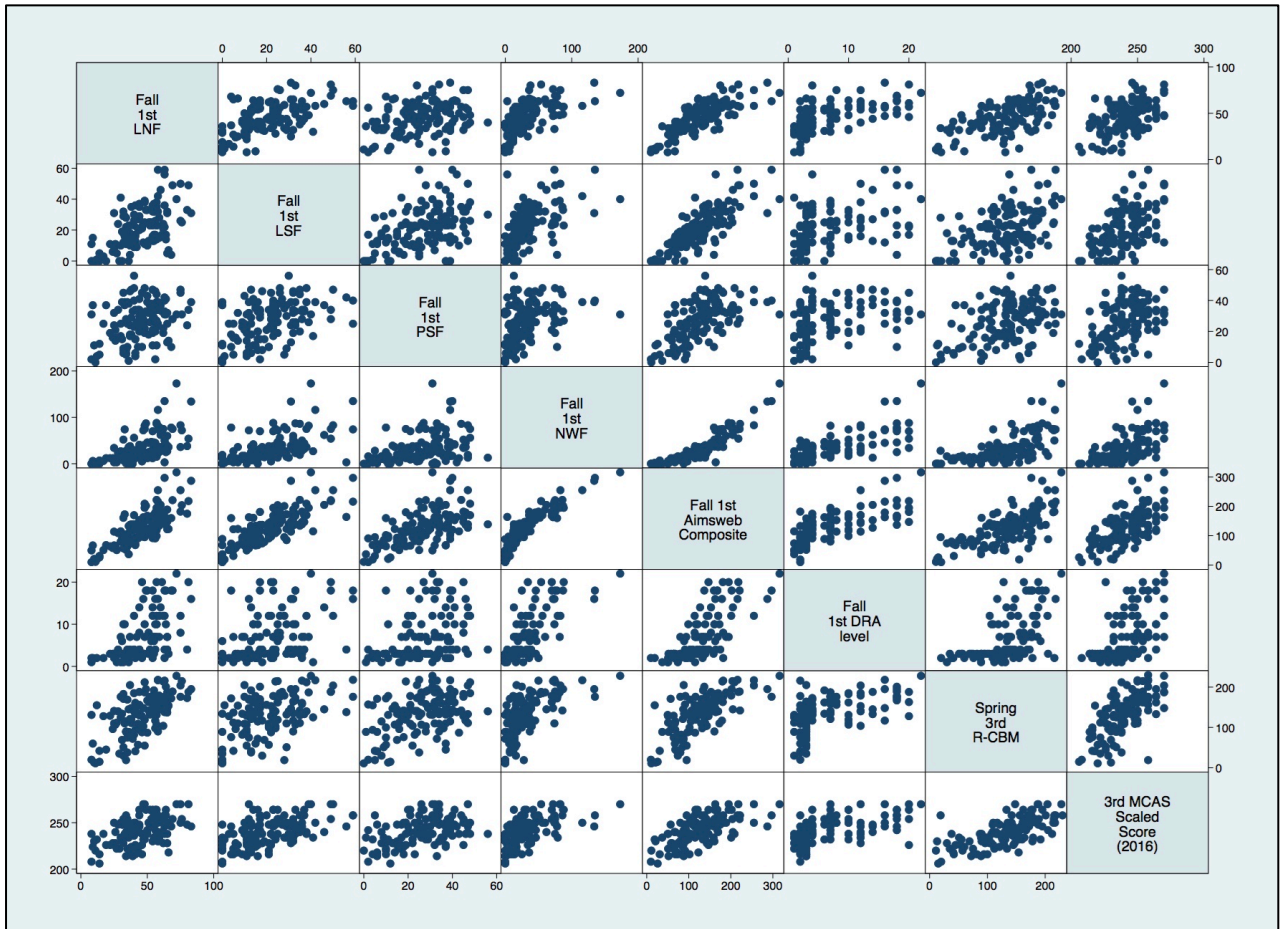
Histograms of First-Grade Screeners and Third-Grade Outcomes (Cohort 1)



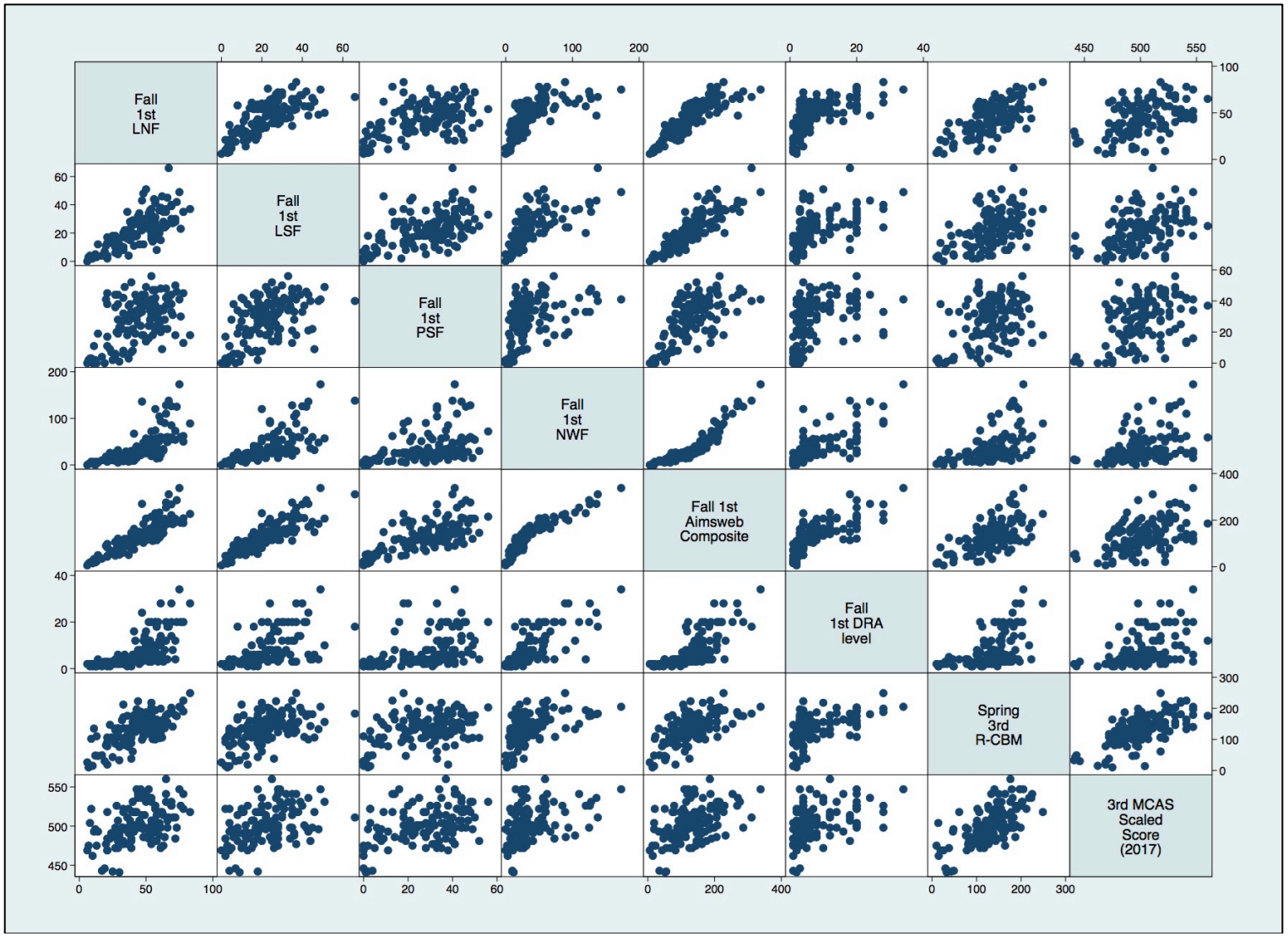
Histograms of First-Grade Screeners and Third-Grade Outcomes (Cohort 2)

APPENDIX F

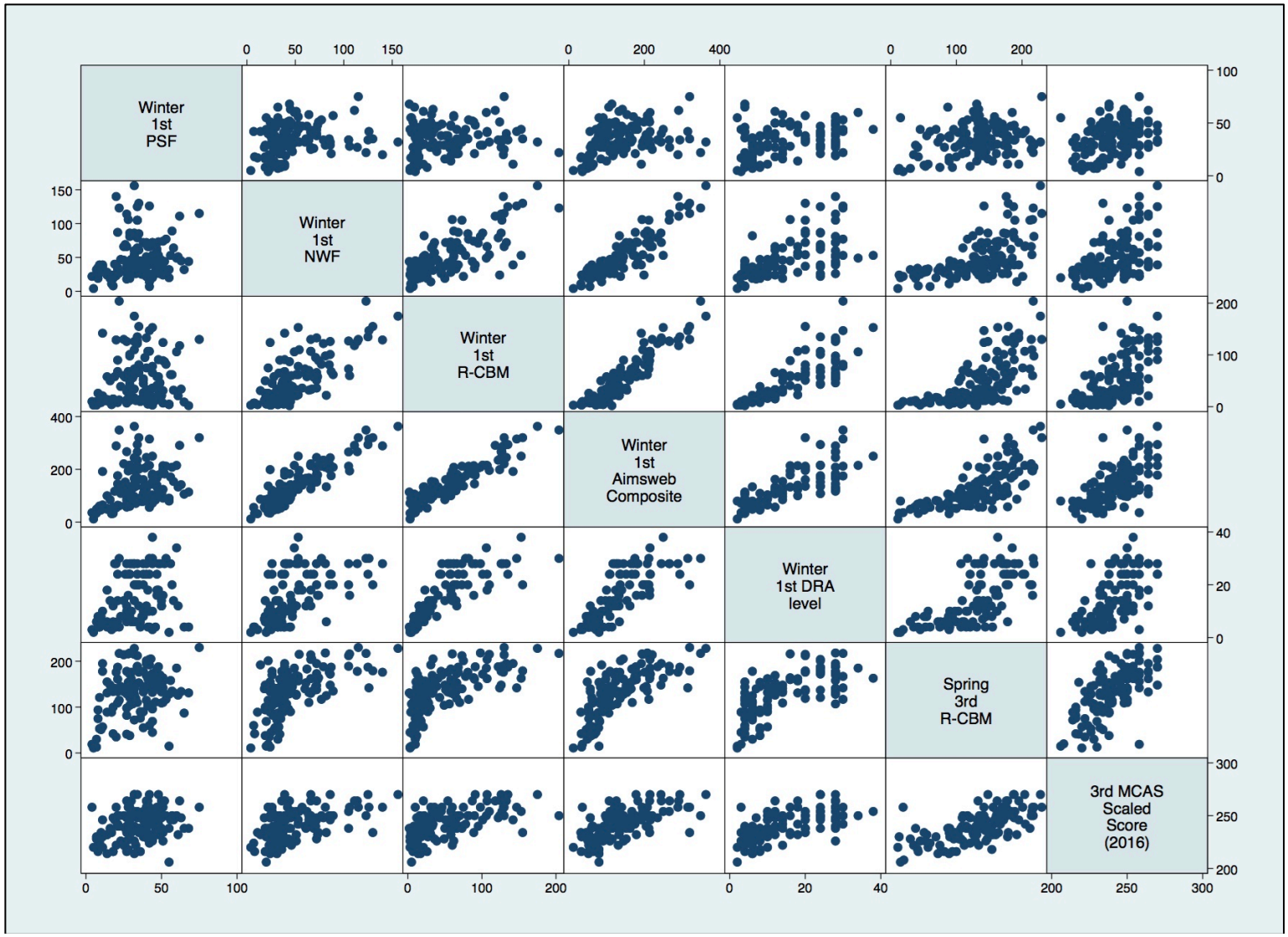
SCATTERPLOTS OF VARIABLES



Scatterplots of Fall First-Grade Screeners and Third-Grade Outcomes (Cohort 1)



Scatterplots of Fall First-Grade Screeners and Third-Grade Outcomes (Cohort 2)



Scatterplots of Winter First-Grade Screeners and Third-Grade Outcomes (Cohort 1)

Scatterplots of Winter First-Grade Screeners and Third-Grade Outcomes (Cohort 2)

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