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Classroom Teachers' Formative Data Use For Instructional Decision-Making Within Tiered Academic Interventions

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CLASSROOM TEACHERS' FORMATIVE DATA USE FOR INSTRUCTIONAL DECISION-MAKING WITHIN TIERED ACADEMIC INTERVENTIONS

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DEDICATION

This work is dedicated to all of those that have been a part of my journey in education, from the classroom to higher education. This would certainly not have been possible without the encouragement and support, over the years, from my family, friends, professors, co-workers, students and their parents. Each of them has inspired my passion to continue to learn and advocate, so that students and teachers can not only believe in their abilities but also experience success in the classroom and beyond.

Moreover, this work is dedicated to my family, who always lifts me up, and never lets me down. I love them all more than anything in this world.

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ABSTRACT

This quantitative study investigated current data-based instructional decision-making (DBIDM) practices of K-3 general education teachers implementing a MTSS/RTI model to address students' academic needs. A thirty-item electronic survey was designed to examine and measure aspects of K-3 general education teachers' formative data use and perceptions in relation to their DBIDM practices including their experience, knowledge, training, school-based supports, and the impact on student learning. Data were obtained from K-3 general education teachers within 35 primary and elementary schools across four South Carolina school districts identified as implementing RTI district-wide (in all primary and elementary schools) and school-wide (at each grade level).

The findings demonstrated that teachers' measurement and evaluation practices varied greatly, relying on informal and unsystematic measures of student progress, more often than formative evaluation using CBM, within Tiers 1 and 2 of RTI. In addition, despite the availability of various school-based supports, teachers reported time as a major barrier to their ability to use data to guide instructional decision-making. The findings also demonstrated a statistically significant relationship between teachers' reported DBIDM practices within Tier 1and perceived preparedness for all aspects or steps of progress monitoring, as well as perceived impact on student learning outcomes. The implications for both practice and research are discussed.

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LIST OF ABBREVIATIONS

AYP....................Adequate Yearly Progress

CBM....................Curriculum-Based Measurement

DBIDM....................Data-Based Instructional Decision-Making

DBPM....................Data-Based Program Modification

DDDM....................Data-Driven Decision-Making

MTSS....................Multi-Tiered System of Support

RTI....................Response to Intervention

SRBI....................Scientific, Research-Based Instruction

CHAPTER 1

Nature and Significance of the Problem

Personnel at state education agencies (SEAs), local education agencies (LEAs), and schools, including administrators and teachers, are responsible for making decisions that provide all students with meaningful learning opportunities. A current trend in education is the use of data-driven decision-making (DDDM; Mandinach, Honey, & Light, 2006). The aim of DDDM is for data to be used as the basis for making decisions at the state, district, school, and classroom levels (Marsh, Pane, & Hamilton, 2006).

Accountability for the learning of all students has been emphasized since the passage of the Elementary and Secondary Education Act (ESEA) in 1965, renamed as the No Child Left Behind Act (NCLB) in 2001, and the Education of All Handicapped Children Act (EAHCA) in 1975, renamed and amended as the Individuals with Disabilities Education Act (IDEA) in 1990. The emphasis on accountability since the reauthorization of both ESEA and IDEA has encouraged more large-scale initiatives for improving school and student success. School-based assessment, therefore, has been in the spotlight as the primary means for collecting data on which to base decisions and gauge effectiveness of school improvement efforts for meeting standards-based accountability requirements using scientific, research-based instruction (SRBI; Cusumano, 2007). Decisions made at the SEA, LEA, school, and classroom levels differ in focus, making various types of data necessary in each context. Different stakeholders are using a variety of sources to produce a database for decisions.

These sources range from records of school attendance, student demographics, and dropout rates, to both informal and formal assessment methods and measures, such as classroom tests, assignments, homework, local tests for benchmarking, end-of-year state tests and achievement tests (Cooke, Heward, Test, Spooner, & Courson, 1991; Marsh et al., 2006; Wixson & Valencia, 2011). Unfortunately, the term *assessment* has become synonymous with the high-stakes standardized state assessments that have gained much attention in state and federal policies (Marsh et al., 2006). However, rather than guiding instructional decisions at the classroom level, the data from these assessments are more useful at the SEA, LEA, and school levels for understanding more general patterns of overall performance. These patterns help with decision-making in relation to Adequate Yearly Progress (AYP) requirements within NCLB of 2001 (Marsh et al., 2006; U.S. Department of Education, 2003; Yell, 2016).

Teacher decision-making in the classroom relates specifically to instruction, that is, data-based instructional decision-making (DBIDM). Deno (1992) suggested the assessments which are most useful for teachers, are objective, repeated over time, and collected during instruction (i.e., formative), such as frequent progress monitoring using curriculum-based measurement. Frequent measurement and evaluation of student progress within the curriculum, provides teachers with the instructionally relevant database necessary to plan, implement, and adjust their instruction at class-wide and individual levels (Stecker, Lembke, & Foegen, 2008). Increased focus on standards-based accountability in education has intensified the efforts to individualize instruction for students with and without disabilities in both general and special education settings, particularly as inclusive placements for students receiving special education and related services continue to increase year after year (Keno, Aud, Johnson, Wang, Zhang, Rathbun, Wilkinson-Flicker, & Kristapovich, 2014). To support these efforts, school-wide initiatives are being implemented for prevention and intervention that encourage a continuum of services between general and special education to ensure that all students' needs are met appropriately across settings. One large-scale initiative is Multi-Tiered System of Support (MTSS).

MTSS models include four essential components: multi-level prevention, screening, progress monitoring, and data-based decision-making (Hayes & Lillenstein, 2015). A MTSS model structures ongoing measurement and evaluation of student outcomes as a result of standards-based instruction school-wide. Within MTSS models, data from screening and progress monitoring of students' performance are used as the basis for making instructional decisions. Instruction and supports are then provided to all students, including those identified as being at risk of poor learning outcomes, through increasingly intensive tiers (or levels) of instruction that correspond with students' demonstrated needs. Typically, MTSS models consist of three tiers with increasingly intensive instruction. MTSS, therefore, creates a continuum of service delivery that emphasizes (a) high quality core instruction for all students at Tier 1, (b) additional targeted instruction for some students at Tier 2, and (c) additional intensive individualized intervention for a small number of students at Tier 3 (Hayes & Lillenstein, 2015; National Center on Response to Intervention [NCRTI], 2014).

Hayes and Lillenstein (2015) suggested that MTSS provides a framework to drive DDDM school-wide for continuous improvement of both instruction and student learning. State curriculum standards guide teachers in what to teach, by broadly outlining what students should know and be able to do at each grade level. MTSS, therefore, guides teachers in how to teach by structuring how students will learn these skills, that is, delivery of "high quality instruction, and when needed, additional supports and interventions varying in intensity" (p.4, Hayes & Lillenstein, 2015). Collecting, analyzing, and responding to progress monitoring data allow teachers to determine how they can provide students with instruction tailored appropriately to meet them at their current level of knowledge and produce the greatest gains in learning, as well as provide evidence of daily efforts in the classroom, of both themselves and their students (Hosp & Ardoin, 2008). MTSS, therefore, bridges standards-based accountability and teacher evaluation with a strong focus on instructional practices that improve students' achievement as a result of instruction that is relevant to state standards (Hayes & Lillenstein, 2015).

Progress monitoring, a research-validated method of assessment, includes frequent objective measurement and systematic evaluation of student performance (Stecker, Lembke et al., 2008). This data is collected during the course of instruction. It involves formative assessment, as opposed to summative assessment, which refers to data collected at the end of instruction. This type of assessment is central to a teacher's ability to individualize instruction in ways that meet students' learning needs to affect improved achievement (Hosp & Ardoin, 2008). Formative assessment, therefore, is essential to good instruction because the frequent collection and evaluation of data documenting students' progress can guide teachers' instructional decision-making and teaching practices to potentially prevent or remediate underachievement (U.S. Department of Education, 2006). Systematic processes and procedures have been developed for formative data collection including data-based program modification, curriculum-based measurement, formative evaluation, and MTSS (Deno, 1985, 1992, 2003; Deno & Mirkin, 1977; Fuchs & Fuchs, 1986; Hayes & Lillenstein, 2015). These methods form the foundation of data use for teacher application of DBIDM practices at the classroom level, to promote individualization and achievement school-wide.

Data-based program modification (DBPM; Deno & Mirkin, 1977) was developed to provide teachers with the steps necessary for individualization at the classroom level. These steps include (a) the use of frequent and objective measurement for goal setting, collecting data, and graphing of results; and (b) the frequent evaluation of graphed results for applying data-utilization rules and responding to patterns or trends in student performance data by making instructional adjustments. To explore the validity of DBPM as an approach to improve special education, Deno and his colleagues were awarded a federal grant to develop an empirical research and development program at the University of Minnesota. This federally funded program, Institute for Research on Learning Disabilities (IRLD), included research on DBPM for six years. The aim of the IRLD was to develop and research the validity of an evaluation system that teachers could use to improve their effectiveness in teaching students with academic problems (Deno, 1992). The system developed at the IRLD was called curriculum-based measurement (CBM). By design, CBM provides teachers with standardized, simple, valid, and efficient procedures for continuous measurement and evaluation of student progress (Deno, 1985, 1992, 2003).

The application of procedures defined in CBM created a systematic process of continuous objective measurement and regular evaluation known as formative evaluation

(Fuchs & Fuchs, 1986). Formative evaluation allows teachers to monitor student progress as a result of varied instruction. Fuchs and Fuchs (1986) investigated the effect of formative evaluation in a meta-analysis of 21 studies that included both general and special education students and settings. Across all studies, the researchers found statistically and practically significant evidence of increased student achievement from the use of systematic formative evaluation—in comparison to unsystematic evaluation—for both students with disabilities and without disabilities, with a weighted average effect size of .70. In particular, Fuchs and Fuchs (1986) determined that increases in student achievement were higher when teachers in the analyzed studies graphed data rather than just recorded scores; reviewed data regularly for trends, then applied standardized data-use rules rather than professional judgment to determine the need for instructional adjustments; and provided reinforcement for academic behaviors (e.g., providing feedback to students on their progress).

In a meta-analysis of studies of CBM in reading, Reschly, Busch, Betts, Deno, and Long (2009) found that the CBM Oral Reading measure (R-CBM) was a statistically significant, and strong predictor of students' performance on other standardized reading achievement tests (weighted $r = .67$), including both national tests, $t(139) = 4.56$, $p < .001$; and state-specific tests of reading standards, $t(139) = 46.92$, $p < .001$. Variability was found in terms of test source and administration format, which supported the use of R-CBM with individual students. In addition, R-CBM performance was more highly correlated to national tests than state-specific tests, which is likely due to the variation in overall reading achievement focus in national tests versus grade level standards focus in state tests. However, the correlation between R-CBM and state-specific tests that does exist provides support for the use of this measure within general education, particularly for screening and identification purposes to determine if students are at-risk of not meeting proficiency on state assessments. Additionally, R-CBM performance was found to be a statistically significant predictor of reading outcomes for third grade students, $t(147) = 34.02$, $p < .001$; and of reading comprehension, $t(131) = 31.01$, $p < .001$. There was not a statistically significant difference found for vocabulary and decoding indicating that performance on R-CBM was related to vocabulary, decoding, and other reading skills just as much as comprehension. Although there was a statistically significant increase for the word identification subtest, $t(131) = 4.71$, $p < .001$. This suggested that R-CBM has a stronger relationship to word reading skills than comprehension, decoding, and vocabulary.

The technical features and adequacy of these formative evaluation practices have evolved largely as a result of several studies conducted by a group of special education researchers, most of whom were involved in the development and investigation of DBPM, CBM, and formative evaluation (Fuchs, Fuchs, Bishop, & Hamlett 1992; Fuchs, Fuchs, & Hamlett, 1989a, 1989b, 1991). Currently, the type of formative evaluation most frequently used in schools is CBM (Deno, 1992, 2003; Reschly, Busch, Betts, Deno & Long). CBM provides reliable and valid data through direct and frequent measures of student achievement that demonstrates a student's (a) current level of proficiency on skills within the curriculum, (b) rate of progress over time, (c) progress and performance in relation to instructional changes, and (d) performance in relation to peers (Deno, 1985, 1992). Overall findings have shown that frequent measurement and evaluation using CBM improve student achievement and teachers' planning of effective instruction in both general and special education settings when compared to unsystematic progress monitoring such as conventional unit tests, unsystematic observations of performance, or work samples (Fuchs, Fuchs, Bishop, & Hamlett 1992; Fuchs, Fuchs, & Hamlett, 1989a, 1989b, 1991).

In these studies, researchers have provided evidence to support the procedures for measurement with CBM, including (a) using the initial three measures to establish a baseline of current performance, (b) using end-of-year criterion for initial goal setting, (c) graphing these points and connecting them to establish an aim line, and (d) continuing the cycle of administration, scoring, and graphing for each subsequent measurement. Fuchs, Fuchs, and Hamlett (1989b) asserted that to produce greater achievement gains, CBM must include both measurement and evaluation of the data collected; however teachers may be more likely to measure student progress alone and not use the data to guide instructional planning. To provide evidence of the importance of teachers' data use, the researchers investigated the effects of systematic measurement (e.g., collection of performance measures) and evaluation (e.g., use of performance data to introduce instructional change) using CBM. Fuchs, Fuchs, and Hamlett (1989b) found that special education teachers' measurement and evaluation of data resulted in greater improvements in students' reading achievement than measurement alone.

The procedures for evaluation with CBM have also evolved as a result of this research, which provided evidence to support the regular review of graphed measurement data, and the application of standard data-decision rules for determining the need for instructional adjustments and effectiveness of instruction. In all of the studies, graphed progress was reviewed visually after approximately 4 to 8 graphed points (measurements), at which time comparisons between actual performance and expected performance were made. Then standardized data decision rules were applied, including: data-point rules, trend-based rules, or a combination of the two (Fuchs et al., 1989a, 1989b, 1990, 1991). Decisions were made, in response to evaluation of students' data, to (a) raise the goal level when performance was higher than expected (i.e., dynamic goal setting; Fuchs et al., 1989a), (b) make an instructional adjustment when performance was below expectation (e.g., targeting needs identified through skills analysis; Fuchs et al., 1990), or (c) continue current instruction with further monitoring when actual performance was in line with expectations.

Fuchs, Fuchs, and Hamlett (1991) investigated the effects of expert system advice to support measurement and evaluation with CBM, finding that the use of CBM in comparison to conventional progress monitoring resulted in more goal increases, more frequent instructional adjustments, and greater improvement in student achievement. Although teachers' use of CBM with expert system advice did not affect student achievement differently than CBM without expert system advice, without expert system advice for instructional planning and changes, special education teachers relied more heavily on measurement feedback. These findings further supported the need for instructionally relevant information, including student responses for skills analysis and performance indicators, for use during evaluation (Fuchs et al., 1990, 1991).

General education teachers, like special educators, have demonstrated the need for recommendations when making instructional changes that are responsive to progress monitoring data. Fuchs, Fuchs, Bishop, and Hamlett (1992) extended their research from the special education setting for individual decision-making to the general education setting for class-wide decision-making. The researchers found that general education teachers were able to implement CBM class-wide. General education teachers' instructional plans included more sound teaching methods when class-wide reports included instructional recommendations than when reports did not. Additionally, greater student achievement in math, for both low and high achieving students, was demonstrated for general education teachers who received class-wide reports that included instructional recommendations.

The protocol and procedures of CBM for formative evaluation create a cycle of collection, analysis, and response to assessment data that informs instruction. The application of similar procedures, to individualize instruction and improve student achievement of curricular standards, is expected as part of a school-wide MTSS (Hayes & Lillenstein, 2015). Response to Intervention (RTI), an example of MTSS, is a school-wide framework of prevention and intervention with four essential components: multiple tiers (levels), screening, progress monitoring, and data-based decision-making (NCRTI, 2010). In RTI, both teachers and school-level teams use data from screening and progress monitoring to identify students at risk of not meeting grade level proficiency, and individualize instructional supports with increasing intensity at each tier of support (Fuchs & Fuchs, 2006; Stecker, Fuchs, & Fuchs, 2008). Because schools can develop the features of their implemented RTI model in accordance with SEA and LEA requirements, models often vary. However, experts (e.g., Fuchs & Fuchs, 2006; Johnson, Mellard, Fuchs, & McKnight, 2006) have made recommendations to use three tiers of support – Tier 1, Tier 2, and Tier 3. At each tier, instruction and intervention should be evidence-based, differentiated appropriately to meet the needs of diverse learners, and implemented with fidelity (Stecker et al., 2008). RTI models may also vary based on the approach to intervention: problem solving (i.e., instruction, assessments and interventions tailored individually to meet students' targeted needs; NCRTI, 2014), standard treatment protocol (i.e., interventions, assessments and instructional programs in which all students receive the same intervention or curriculum as designed; Johnson et al., 2006), or hybrid (a combination of these approaches). Whereas a number of districts have adopted the problem solving approach, and many practitioners prefer it, experts (e.g., Fuchs & Fuchs, 2006; Johnson et al., 2006) have recommended the use of a standard treatment protocol, particularly for persistent academic difficulty (e.g., at Tier 2) because these treatments are typically more intensive than instruction at Tier 1 (Fuchs & Fuchs, 2006).

Regardless of the potential variations, when addressing students' academic needs through RTI or similar MTSS models, expert guidance collectively suggests a systematic process through which assessment informs instruction, that is, standardized procedures for measurement and evaluation (Hayes & Lillentstein, 2015; Johnson et al., 2006; NCRTI, 2014). DBIDM within RTI, therefore, should include (a) objective measurement using CBM for screening and formative benchmarking of all students and frequent progress monitoring of students identified as at-risk, (b) charting and graphing results of student progress measurements, (c) applying standardized data decision rules, and (d) intensifying SRBI that is increasingly targeted and explicit (Fuchs & Fuchs, 2006; Fuchs & Fuchs, 2006). As a result, systematic formative evaluation using CBM should be used at each tier within RTI to create a continuum of services that promote the success of students, teachers, and schools.

Marsh, Pane, and Hamilton (2006) asserted, however, that it is rare to find teachers with a routine of thinking critically about the relationship between their own instructional practices and student learning outcomes. Special and general education teachers reported using multiple sources for data on student performance. However, rather than using standardized, systematic and objective assessment methods and measures, most prefer and use types of assessment methods that are subjective, insensitive to growth, informal and unsystematic (Cooke et al., 1991; Deno & Mirkin, 1977; Fuchs, Deno, & Mirkin; 1984; Fuchs et al., 1989a, 1990; Marsh et al., 2006). Data resulting from these measures are not timely or specific enough to guide instruction that is effective in improving student learning; and difficult to organize, display, and interpret graphically for applying data decision rules.

Cooke, Heward, Test, Spooner, and Courson (1991) investigated measurement and evaluation practices of special education teachers. The researchers determined that although most teachers found collecting frequent and objective measurements of progress important, in-class written assignments were used most often to monitor student progress. Additionally, very few teachers reported graphing, organizing, or evaluating the data collected from student progress measures. Similar studies, with a primary focus on data use practices, have not been conducted with general education teachers. However, insights into the types of data collected and their use by general education teachers have been described within some research literature. As with special education teachers, general education teachers have opted for unsystematic classroom tests and assignments that better match daily instruction, preferring this for making class-wide decisions over local benchmark assessments or state tests, with no mention of graphing, organizing, or evaluating the data (Kerr, Marsh, Ikemoto, Darilek, & Barney, 2006; Marsh et al., 2006).

Jacobs, Gregory, Hoppey, and Yendol-Hoppey (2009) suggested that teachers' ability and preparedness to use data formatively for making instructional decisions at the classroom level may depend on both experience and knowledge. Influential factors and barriers to teachers' DBIDM practices relate to teacher professional knowledge about data and the culture of support for data use in the school setting (Cooke et al., 1991; Kerr et al., 2006; Mandinach et al., 2006; Marsh et al., 2006; Yell, Deno, & Marston, 1992). Thus, researchers suggested training is needed for both pre-service and in-service teachers focusing on the purposes and procedures of CBM implementation (Cooke et al., 1991; Jacobs, Gregory, Hoppey, & Yendol-Hoppey, 2009; Yell et al., 1992); and should be followed by ongoing support from school leaders, curriculum specialists, and teacher colleagues through formats such as consultation, mentoring, and/or peer coaching (L.S. Fuchs et al., 1991, 1992; Jacobs et al., 2009; Vernon-Feagans, Kainz, Amendum, Ginsberg, & Wood, 2012; Yell et al., 1992).

The current literature base provides only broad guidance for teacher data use as part of DDDM, a critical component of the cycle of inquiry for making and testing hypotheses of how to improve student learning (Hamilton, Halverston, Jackson, Mandinach, Supovitz, & Wayman, 2009). In addition, although research suggests that when teachers have the appropriate training and support to apply the evidence-based protocol and procedures for DBIDM, their instruction is likely to be more effective, a similarly strong body of research does not exist for general education teachers and DBIDM within RTI models. Because most of the instruction within RTI is provided at

Tiers 1 and 2 by the general education teacher this makes general education teachers' DBIDM practices essential to both student learning outcomes and successful RTI implementation.

Problem Statement

In the literature, researchers suggest that there is a great deal of data resulting from assessments in education. However, for teachers to make appropriate educational decisions at the classroom level, these data must be relevant to instruction and analyzed. This makes the data useful to teachers for implementing meaningful changes to instruction that result in improved student learning. Researchers also suggest that despite the evidence base for systematic frequent measurement and evaluation, DBIDM practices of teachers in both general and special education vary in (a) types of assessment methods and measures used to monitor progress, and (b) how the data are used during evaluation (Cooke et al., 1991; Fuchs et al., 1991; Kerr et al., 2006; Marsh et al., 2006). In addition, researchers suggest that for teachers to use data formatively for making class-wide and individual instructional decisions, teachers require professional knowledge, training, and school-level supports (Fuchs et al., 1992; Jacobs et al., 2009; Yell et al., 1992).

In recent literature, researchers emphasized the importance of data use in all educational contexts; however, there has not been a direct connection to the earlier established evidence base of CBM and formative evaluation for suggested teacher practice. Because these procedures were aimed in guiding teachers at the classroom level, this may illustrate a significant gap within the literature, as well as between research and practice.

In order to effectively meet instructional requirements and practical obligations of accountability as emphasized in NCLB and IDEA, teachers should use DBIDM practices. At the classroom level, explicit and systematic procedures allow DBIDM to become a seamless part of effective practice that leads to positive learning outcomes. Researchers have not focused specifically on general education teachers' use of evidence-based practices for DBIDM at the classroom level, particularly within RTI.

Although researchers have highlighted that teachers need experience, knowledge, training and supports in order to use data formatively, there has not been specific focus on how these components influence general education teachers' DBIDM practices as part of their school's RTI model. Because RTI is a widely used model for guiding school-wide DBIDM, this may illustrate a significant gap within the literature. To date, no studies have investigated (a) if general education teachers are using data from instructionally relevant assessment measures formatively; (b) how general education teachers' perceive their DBIDM in relation to experience, knowledge, training, and supports; and (c) how general education teachers' perceptions of components that contribute to effective data use impact their DBIDM practices in the classroom, all particularly within RTI models.

Purpose Statement

The purposes of this study were (a) to investigate the current DBIDM practices of general education teachers for making class-wide and individual instructional decisions within their school's RTI model at Tiers 1 and 2, and (b) to determine the relationship between teachers' reported perceptions of influential data-use factors, barriers, supports and DBIDM practice at Tier 1 of RTI. Results were used to describe how teachers reported using data from assessments of student performance and progress to plan effective instruction and interventions at Tiers 1 and 2; teachers' perceptions of their DBIDM practices, within Tiers 1 and 2, in terms of experience, knowledge, training, support, and effect on student learning outcomes; and how teachers' perceptions influenced their DBIDM practices at Tier 1 of RTI. Understanding how teachers are using data formatively for planning effective instruction that meets the diverse needs of learners in their classrooms, as well as how their perceived data-use knowledge, training and supports impact such practice, contributes to an area that has received little attention in the literature. The findings of this study inform future research and efforts to design and implement ongoing supports for DBIDM at the classroom level.

Research Questions

This study was conducted to answer the following research questions:

RQ 1: How do teachers report using data formatively to make classroom-level instructional decisions for students at Tiers 1 and 2 of their school's Response to Intervention (RTI) model?

RQ 2: What are teachers' perceptions of the impact their DBIDM practices have on student learning?

RQ 3: What are teachers' perceptions of the importance of and their preparation for progress monitoring as a part of DBIDM?

RQ 4: What are teachers' perceptions of factors, barriers, and school-based supports for their use of DBIDM practices?

RQ 5: What is the relationship between teachers' reported DBIDM practices within Tier 1 of RTI, and their perceptions of the impact of these practices on student learning, importance of and preparedness for progress monitoring, and school-based supports?

Method Summary

To answer each of these research questions, K-3 general education teachers in 35 primary/elementary schools across four South Carolina school districts, where RTI or similar MTSS is being implemented district-wide, were asked to complete a web-based survey. Quantitative analyses were used to analyze the survey responses. Descriptive statistics for close-ended items and content analysis for open-ended items were used to describe trends and patterns in teacher reports of their classroom level DBIDM practices, as well as their perceptions of related factors, barriers, supports, and effects on student learning outcomes within Tiers 1 and 2 of RTI. Inferential statistics were used to determine the influence of teachers' perceptions of related factors, barriers, supports, and effects of student learning outcomes on their reported DBIDM practice within Tier 1 of RTI.

Definition of Terms

Adequate yearly progress (AYP) is a criterion defined and submitted by states each year to the U.S. Department of Education for increasing student achievement towards 100% proficiency in both reading and math, by the 2013-2014 school year, as required for funding under No Child Left Behind (Yell, 2016).

Curriculum-based measurement (CBM) is an assessment approach, in which alternate and equivalent forms of CBM tests can be used regularly as a measurement tool, to screen and/or monitor student performance and progress within the curriculum. Using standardized administration and scoring procedures, frequent CBM provides reliable and valid data of students' current level of performance and growth over time, in targeted curriculum content areas such as mathematics, reading, writing, and spelling. (National Center on Response to Intervention [NCRTI], 2014).

Data-based instructional decision-making (DBIDM) is a term created by the author and used in the context of this study in specific reference to ongoing data use by teachers at the classroom level to inform instruction and intervention.

Data-based program modification (DBPM) is a continuous, systematic process for making instructional adjustments to individualize classroom instruction to meet the needs of students with learning and/or behavioral difficulties. These methods include frequent measurement and evaluation of student learning as a result of instruction, to guide teachers' instructional decision-making. (Deno & Mirkin, 1977).

Data-driven decision-making (DDDM) is the ongoing, systematic process of collecting and analyzing various types of data in order for teachers, principals, and administrators to make sound educational decisions at various levels that are aimed to promote the success of both students and schools (Marsh, Pane, & Hamilton, 2006). Similar terms used interchangeably in the literature to describe the ongoing use of data to inform educational decisions include *data-based decision-making* and *data-informed decision-making*.

Formative evaluation is a systematic process of ongoing measurement and evaluation of student progress, using technically adequate measures, that provides data for developing instructional procedures and programs empirically (Fuchs & Fuchs, 1986).

Multi-tiered system of support (MTSS) provides a framework for organizing resources school-wide to address individual students' academic and/or behavioral needs.

MTSS models include early identification of learning and behavioral challenges, and provision of additional supports for students identified as at-risk of poor learning outcomes. Within MTSS, additional supports are provided through a continuum of increasingly intensive intervention tiers (e.g., Tier 1, Tier 2, Tier 3) or levels of prevention (e.g., primary, secondary, tertiary; NCRTI, 2014). Similar terms used interchangeably in the literature include *multi-level prevention system,* and specific examples of MTSS models for addressing students' academic needs, *Response to Intervention (RTI),* and behavioral needs, *Positive Behavioral Interventions and Supports (PBIS).*

Progress monitoring is a research-validated assessment method that includes systematic measurement of students' academic performance and progress within the curriculum, at regular intervals, to: a) determine the benefit of instruction; b) adjust instruction that is not beneficial; and c) determine rates of progress as a result of instruction. Particularly in MTSS/RTI, progress monitoring data is used to quantify students' current level of performance and rate of progress (i.e., responsiveness to instruction and intervention supports) within each tier. Based on systematic evaluation of students' data, adjustments are made to instructional programs, with continued measurement to evaluate the effectiveness of instruction and interventions on producing improvements in students' rates of progress. (Johnson, Mellard, Fuchs, & McKnight, 2006; NCRTI, 2014).

Response to intervention (RTI) provides a framework to guide a systematic process of assessment and intervention to address learning difficulties in academics. Decisions are made, based on screening and progress monitoring data, about individual students' need for additional instructional supports or adjustments provided through increasingly intensified tiers. RTI is an MTSS model that structures academic instruction and interventions to match students' academic needs for progressing towards proficiency within the general curriculum. (Johnson et al., 2006; NCRTI, 2014).

Scientific, research-based instruction (SRBI) are instructional practices that are based on rigorous research. Such research must be conducted in a manner that follows systematic and objective procedures to yield valid and reliable results that can be applied in the educational setting. (20 U.S.C. § 7801[36][A])

CHAPTER 2

Literature Review

For this literature review, I focus on the practices of collecting and using formative data in both general and special education settings with an emphasis on teachers' classroom-level decision-making, particularly in terms of how these practices relate to decisions within tiered intervention systems. The chapter is divided into five sections. In the first section, I provide an overview of data-based instructional decision-making at the classroom level. In the next section, I describe the history and development of data-based assessment practices, including accountability-related legislation, curriculum-based measurement, and progress monitoring. In the third section, I explain the foundations of data use, and its long-standing presence in the literature as essential practice for meeting the learning needs of students with and without disabilities. In section four, I present the benefits of applying data-use procedures, including evidence of improved student achievement and instructional effectiveness in earlier special education research. In the final section, I outline teachers' knowledge and use of data-use procedures, including barriers, factors, supports, and suggestions for improving data-use practices across general and special education settings.

Data-based Instructional Decision-Making

Data-based instructional decision-making (DBIDM) is a process of systematic collection and analysis of student performance data to make and implement instructional decisions for improved learning outcomes. The goal of DBIDM in the classroom is to use data from frequent assessments of student performance, to plan effective instruction in terms of (a) selecting appropriate curricula, (b) differentiating instruction, (c) selecting and implementing instructional materials and procedures, and (d) evaluating the effectiveness of instruction (Fuchs & Fuchs, 2006; Jacobs, Gregory, Hoppey, & Yendol-Hoppey, 2009).

In the classroom, teachers make instructional decisions on a daily basis. As they measure and investigate student learning through assessment, they must be able to use the results during data review to adapt and develop their instructional practices; practices that in the face of accountability are being scrutinized in terms of teachers' impact on student achievement (Ball & Cohen, 1999; Cusumano, 2007). Measuring achievement and learning outcomes of students is essential to being able to gauge the effectiveness of instructional programs in education (Deno, 1985). In order to effect change in achievement or close the achievement gap, teachers must be able to observe students' academic behaviors to determine the benefit of their instruction and make structured changes that lessen any difference between observed performance and desired performance (i.e., discrepancy; Deno & Mirkin, 1977; Hosp & Ardoin, 2008). Effective DBIDM practices at the classroom level include teachers' collection and use of data from frequent measurement of student performance to (a) determine students' academic needs in specific areas of the curriculum, (b) plan their instruction, and (c) guide both class-wide and individual decision-making. Such practices are critical to ensuring that instructional time is used effectively to address students' documented learning needs for progressing in the curriculum (Hosp & Ardoin, 2008; Stecker, Lembke, & Foegen, 2008).

History and Development of Data-based Assessment Practices

The research on DBIDM practices has operationalized, for both general and special education, the relationship between assessment of student performance and instruction that has been in educational law for more than 40 years. A quality educational opportunity for all children has been a focus in education since 1965 with passage of the Elementary and Secondary Education Act (ESEA; 1965). With ESEA, the first federal funding was provided to states for improving the education of students with disabilities, however students with disabilities continued to be excluded from public schools and failed to receive an appropriate education for much of the following decade (Yell, 2016).

In 2001, the ESEA was reauthorized and renamed the No Child Left Behind (NCLB) Act. The law included formalized accountability procedures that went far beyond those of the ESEA. NCLB required standardized state assessments, beginning in third grade, to mark progress towards state curricular standards in reading and math at each grade level (U.S. Department of Education, 2003). These statewide assessments for all students were fundamental in determining if schools and districts were making Adequate Yearly Progress (AYP), required by NCLB, for making accountability decisions (U.S. Department of Education, 2003).

Qualified students with disabilities were provided access to this educational opportunity in public schools—as a core substantive right to a free and appropriate public education (FAPE)—with the passage of the Education for All Handicapped Children Act (EAHCA) of 1975 (Yell & Drasgow, 2010; Yell, 2016). In order to be deemed eligible for special education and related services under EAHCA, a full and individualized assessment was necessary to determine the presence of a disability and the need for special education services (Yell & Drasgow, 2007). In addition to FAPE, EAHCA provided eligible students with the right to (a) due process, (b) parental involvement, (c) nondiscriminatory assessment and placement, and (d) being educated in the least restrictive environment (LRE; Yell, 2016). EAHCA directed that these provisions be in place by 1980 for all eligible students with disabilities, ages 3 through 21; and by 1985 all states met this requirement in order to receive federal funding (Yell, 2016). The LRE mandate within EAHCA required that the education of students with disabilities occur alongside peers without disabilities, in the general education setting, to the greatest extent possible (Yell, 2016).

Since 1970, a continuum of service delivery options has existed to provide a framework for alternate placements so that decisions could be made for providing special education services in the LRE most appropriate for the individual student (Deno & Mirkin, 1977; Yell, 2016). The placement options, which became part of the Council for Exceptional Children's policy statement in 1971, range from least restrictive (e.g., students with disabilities learning in the regular classroom with and without supports) to most restrictive (e.g., homebound learning in hospitals or residential care facilities; Deno & Mirkin, 1977). Over the years, we have seen increased inclusive placements in which students with disabilities are being educated in the general education classroom with collaborative supports provided by both general and special education teachers. According to the most recent report of The Condition of Education, 61% of school aged children served under the Individuals with Disabilities Education Act spent 80% or more of their day in general education classrooms in regular public schools in 2011-2012;

compared to 47% in 2000-2001 and 33% in 1990-1991 (Kena, Aud, Johnson, Wang, Zhang, Rathbun, Wilkinson-Flicker, and Kristapovich, 2014).

In 1990, when Congress reauthorized the EAHCA, the name of the law was changed to the Individuals with Disabilities Education Act (IDEA; Huefner, 2000). In addition to previously required assessments for eligibility, these amendments added provisions to the law for substantive compliance, for example, monitoring and reporting progress towards measurable Individualized Education Program (IEP) goals written for student progress towards curricular standards (Huefner, 2000; Yell & Drasgow, 2007). In 2004, President George W. Bush signed the Individuals with Disabilities Education Improvement Act (IDEIA) of 2004 into law.

IDEIA reauthorized IDEA and aligned the accountability focus with that of NCLB on measuring performance, requiring that students with disabilities (a) be held to achievement of grade level standards, and (b) participate in statewide assessments (Yell & Drasgow, 2007). Both NCLB and IDEIA also encouraged high quality instruction using research-based instructional strategies designed to meet the needs of diverse learners in both general and special education settings, that is, scientific, research-based instruction (SRBI; Cusumano, 2007; Yell & Drasgow, 2007). The intent was for all students to experience meaningful learning opportunities that support attainment of proficiency on general curriculum standards at each grade level in a progression of skills necessary to be college and career ready upon graduation. Student achievement of academic skills within the curriculum had become the responsibility of all teachers, making it necessary to measure learning outcomes of all students. This accountability focus in both general and special education has since linked assessment and instruction by measuring student achievement and holding districts, schools, and teachers responsible for improving those outcomes (Yell & Drasgow, 2010).

IDEIA permitted the use of Response to Intervention (RTI) as a process for early identification and intervention in efforts to help remediate the skills of students with learning difficulties, rather than erroneously identifying students as having a disability (D. Fuchs, Fuchs, & Stecker 2010). In the RTI model, there is a cycle of frequent data collection and evaluation that can aid teachers and school-level teams in identifying changes (or lack of progress) in students' attainment of skills towards proficiency in response to SRBI and interventions (Cusumano, 2007; Yell & Drasgow, 2007). Experts from the National Center on Intensive Intervention suggested that instruction towards college and career readiness within RTI models should focus on relevant instruction in reading and math standards (NCII; n.d.). Therefore, reading instruction should focus on phonemic awareness, alphabetic principle, fluency, vocabulary, and comprehension; and math instruction should focus on number systems and counting, place value, basic facts, fractions as numbers, computation of fractions, and algebra (NCII, n.d.). Systematic measurement and evaluation of students' response to evidence-based instruction are used to identify students with learning difficulties and individualize instructional supports accordingly (Stecker, Fuchs, & Fuchs, 2008). RTI or similar MTSS models have since been implemented increasingly by SEAs and LEAs as a process for DBIDM—including identification and eligibility determination of students with specific learning disabilities (SLD)—at the school, classroom and individual student levels.

The need for DBIDM across both general and special education settings for all learners, particularly those not making adequate progress, was highlighted in the U.S. Department of Education's 2006 regulations clarifying IDEIA:

> "To ensure that underachievement in a child suspected of having a specific learning disability is not due to lack of appropriate instruction in reading or math, the group must consider, as part of evaluation [...] data that demonstrate that prior to, or as part of, the referral process, the child was provided appropriate instruction in regular education settings, delivered by qualified personnel; and data-based documentation of repeated assessments of achievement at reasonable intervals, reflecting formal assessment of student progress during instruction" (34 C.F.R. § 300.309 [b]).

Because teachers are responsible for instructional decisions and practices in the classroom that have the potential to prevent and remediate underachievement, it is critical that data documenting students' progress are systematically collected and analyzed, making assessment essential to good instruction (U.S. Department of Education, 2003). The U.S. Department of Education (2003) also asserted that although testing is important, teacher use of resulting data from assessments is critical in adapting instruction and evaluating student progress. Accordingly, teachers must be knowledgeable of various assessment methods and measures and, perhaps more importantly, understand the purpose and utility of the resulting data. This knowledge is essential to teachers' ability not only to create an instructionally relevant database reflecting formal assessment of student progress but also to use the data for individualizing instruction. The results of teachers connecting assessment and instruction in this way could serve to both help students reach proficiency in basic skills within the curriculum as well as aid in appropriate identification of students with SLD as intended within RTI or similar MTSS models.

Curriculum-based measurement. The practical and legal significance of connecting assessment and instruction for improved student achievement highlights the need for assessment measures that inform instruction in meaningful ways (i.e., provide data that is instructionally relevant; Deno, 1992; Wixson & Valencia, 2011). CBM (Deno, 1985) has been established as a reliable and valid assessment tool that allows for measurement of student performance on the key indicators of basic skills relative to the curriculum (Deno, 1985, 1992, 2003; Reschly, Busch, Betts, Deno, & Long, 2009; Stecker, Lembke et al., 2008). The technical features of CBM—including sensitivity to small changes, appropriateness of frequent administration and ease of use— support DBIDM that is receptive to student needs as demonstrated in their frequently measured response to a teachers' provision of evidence-based instruction and/or interventions over time (Cusumano, 2007; Deno, 1985, 1992, 2003; Reschly et al., 2009; Stecker, Lembke et al., 2008).

As demonstrated in efficacy research, CBM measures change in student performance levels, demonstrates rates of change, and can be used as part of formative evaluation for determining when changes are needed to instruction and/or making placement decisions (Fuchs & Fuchs, 2006; Reschly et al., 2009). CBM, therefore, provides an alternative to traditional assessments such as unsystematic observations or achievement tests, which offer one-time observations of student performance (Deno, 1985, 1992, 2003; Fuchs, Deno, & Mirkin, 1984). The database created through the repeated use of CBM includes scores that are (a) curriculum goal-referenced, which indicate proficiency and progress toward goals within local curriculum, (b) individually-referenced, which indicate change in student rate of progress from measurement to measurement, (c) peer-referenced, which indicate student performance relative to average peer performance, and (d) instructionally-referenced, which indicate change in rate of progress before and after instructional adjustments (Deno, 1985, 1992, 2003). CBM procedures are standardized in terms of what to measure and how to measure, therefore the resulting student performance data can and have been used, with confidence, as the basis for important educational decisions in various contexts (e.g., screening to identify students at risk of school failure; Deno, 1992, 2003; Marston & Magnusson, 1985; Reschly et al., 2009). Similarly, the use of CBM data is recommended for screening and identification decisions, as well as for progress monitoring, to make instructional planning, monitoring, and evaluation decisions in both general and special education settings within RTI and similar MTSS models (Fuchs & Fuchs, 2006; Johnson, Mellard, Fuchs, & McKnight, 2006).

State mandated assessments, including high-stakes standardized tests and general outcome measures such as CBM, are currently used for screening, for diagnostic purposes, and to monitor student performance (Mandinach, Honey, & Light, 2006). Although high-stakes assessments like those required by NCLB are important measures, they provide summative information useful for administrators about overall effectiveness following instruction, rather than information that can be used formatively by teachers during instruction to effect change in student outcomes. Like the assessments mandated in IDEIA to document a student's response to appropriate instruction, repeated formal assessments at regular intervals using CBM for screening, diagnostic, and formative benchmarking purposes provide useful information about student performance before and during instruction. The data from these assessments, however, is too general (or too infrequent) to guide teachers' instructional planning, but are useful for grade-level team and school-wide decision-making—especially in RTI (Wixson, & Valencia, 2011).

Progress monitoring. Assessments most useful for teachers' DBIDM are those that are objective, repeated, and collected during instruction (i.e., formative), such as frequent progress monitoring using CBM (Deno, 1992). Progress monitoring is a research-validated method for assessment that provides teachers with data useful for determining when students are not making satisfactory progress, making instructional changes in response to student performance data, and measuring their growth in response to instruction that is research-based—with CBM being the primary measurement tool for frequent progress monitoring in RTI models (Fuchs & Fuchs, 2006; Johnson et al., 2006; Stecker, Lembke et al., 2008). Stecker, Lembke and Foegen (2008) suggested the following steps for progress monitoring: (a) selecting appropriate measurement materials, (b) evaluating technical features, (c) administering and scoring measures, (d) using data for goal setting, and (e) judging instructional effectiveness. Formative progress monitoring using CBM is characterized as dynamic assessment because it provides information about change in student learning over time which guides evidence-based instruction and decision-making within RTI and similar MTSS models (Deno & Mirkin, 1977; Hayes & Lillenstein, 2015; Stecker et al., 2008; U.S. Department of Education, 2003; Wixson & Valencia, 2011).

In summary, DBIDM practices—both as part of or independent of RTI and similar MTSS models—merge assessment and instruction to allow for individualization within the general education curriculum. By collecting instructionally relevant data from appropriate assessment measures (e.g., benchmark and frequent progress monitoring using CBM) teachers are able to use the data formatively to guide instruction (e.g., modify instructional focus, strategies, and environment) for children with diverse needs in the regular classroom. In addition, teachers can use this data to evaluate the effectiveness of their instruction in promoting student achievement of skills within the curriculum. What essentially is required of teachers for DBIDM at the classroom level is scientific inquiry (Ball & Cohen, 1999), or research using time series data collection and analysis to empirically test instructional changes and determine their effectiveness for student learning (Deno, 1992; Deno & Mirkin, 1977). DBIDM practices—as developed, applied, and supported by researchers in the literature—require repeated objective measurement using CBM and evaluation using quantitative descriptions of student performance for monitoring the reduction of measured discrepancies between actual and expected performance during instruction. In order for teachers to provide instruction that is tailored responsively to students' varying needs, and improve students' achievement as emphasized in both NCLB and IDEIA, these practices are essential (Hosp & Ardoin, 2008).

Foundations of Data Use

The practical significance of DBIDM practices has been outlined in the literature for more than 40 years under various terms such as data-based program modification, CBM, and formative evaluation (Deno, 1985, 1992, 2003; Deno & Mirkin, 1977; Fuchs

& Fuchs, 1986). The need for using data as the basis for educational decision-making has been reemphasized in the literature over the last decade or so with the increased focus on data-driven decision-making. DBIDM practices are recently outlined as part of school-wide frameworks and initiatives including MTSS models, such as RTI. Regardless of the terms used in past and current literature, the long-standing intent has been to encourage systematic approaches for making sound educational decisions aimed at improved student outcomes. Together these frameworks, methods, and processes provide both general and explicit guidance for using data to inform decision-making that includes two essential process components: measurement and evaluation.

Historical Origins of CBM. In early efforts to help guide the type of collaborative supports provided by general and special education teachers, researchers developed data-based program modification (DBPM; Deno & Mirkin, 1977). DBPM is a methodological process for individualizing instruction for students that emphasized the importance of data collection in teacher decision-making. Deno and Mirkin (1977) suggested while decision-making should be based on data, decisions should be viewed as separate from data collection. As a result, DBPM outlines a set of actions that could be followed by teachers in order to produce a data base (i.e., data collection), and evaluate the data for making specific decisions (i.e., data analysis).

To explore the validity of DBPM as an approach to improve special education, Deno and his colleagues were awarded a federal grant in 1977 to develop an empirical research and development program at the University of Minnesota (Deno, 1992). The federally funded program, called the Institute for Research on Learning Disabilities (IRLD), actively researched DBPM for six years. The ultimate aim of the IRLD was to develop and research the validity of a formative evaluation system that teachers could use to improve their effectiveness in teaching students with academic problems (Deno, 1992). The formative evaluation system developed at the IRLD was CBM, which was specifically designed to be low-cost and time-efficient measures that could be administered frequently and easily. As a result, CBM has been applied in both general and special education settings (Deno, 1992).

Deno and Mirkin (1977) asserted data should be collected frequently using CBM to provide objective, precise, and quantitative descriptions of student performance in their current and adjusted instructional environments over time. This creates a continuous cycle of data collection, analysis, and response that teachers in both general and special education settings can use to ensure they connect assessment to instruction that is effective. Deno (1992) described CBM as a tool to allow teachers to "check the vital signs" of students' growth to inform focused instruction that improves student learning of basic skills within the curriculum. Results of these assessments can be used initially to determine if a learning problem exists on a particular part of the general education curriculum. A learning problem is defined as a discrepancy or difference between measured (observed) proficiency and desired proficiency on a specific skill or academic behavior (Deno & Mirkin, 1977). Measurement of progress or changes in student performance can be collected daily, weekly, and/or monthly, however should be obtained at least weekly for making instructional decisions for students whose development is different from same grade/age peers (Deno & Mirkin, 1977).

Deno and Mirkin (1977) also suggested that after determining a problem with learning exists, instruction must then be planned in ways to decrease the discrepancy between actual and desired student performance, including plans for long-term goals, procedures for measuring progress, and teaching strategies aimed at improving achievement. As a general outcome measurement approach, CBM can subsequently be used to frequently measure and monitor student progress for planning and evaluating instruction (Deno, 1992; Fuchs & Deno, 1991). Each measurement with CBM provides data, which can be used to calculate a slope (i.e., a statistic of student growth), which can be used with confidence to make instructional decisions (Deno, 1985, 1992; 2003; Fuchs & Fuchs, 1986). As measurements of student academic behaviors are collected, it is essential for the results to be organized for analysis (i.e., graphed; Deno & Mirkin, 1977; Fuchs & Fuchs, 1986).

Deno and Mirkin (1977) asserted that graphed data of student performance should be reviewed weekly and used frequently to determine the effectiveness of instruction and interventions. In this way, decisions can be made based on objective effects of instruction demonstrated by measurement data rather than subjective opinions (Deno & Mirkin, 1977). Instruction should be provided long enough for effects to appear, at which time rules can be applied to determine when and if the need for instructional change is demonstrated. After 3 weeks, or 15 data points, whichever comes first, Deno and Mirkin (1977) suggested applying a three-point data decision rule during visual analysis of graphed performance: if 3 consecutive points fall below the estimated performance line (goal line), then an instructional change should be introduced.

Deno and Mirkin (1977) suggested that even with individualization within the general education setting, a small number of students might require special education services to receive appropriate and meaningful benefit from instruction. The measurement and evaluation approach of DBPM, on which CBM development was based, includes steps for both general and special education teachers such as (a) measuring student performance on long range goals, (b) choosing and administering assessments to ensure validity of the results, and (c) following data decision rules to reliably determine when instructional changes are needed. In this way, all students are provided with instruction that meets their learning needs wherever they may be on the continuum of services, with learning problems identified as difficulty within the curriculum rather than in terms of disability characteristics (Deno & Mirkin, 1977).

Fuchs, Deno, and Mirkin (1984) conducted an 18-week study on the effects of repeated CBM as part of DBPM with 39 special education teachers, each of whom selected three to four student participants from their classroom for the study. Teachers were randomly assigned to either the treatment group (i.e., conducting repeated CBM and evaluation) or the control group (i.e., conducting evaluations as usual practice). Teachers in the experimental group applied DBPM procedures for goal setting, data collection, graphing data, and applying data utilization rules. Curriculum-based goals were written that described current level of performance, the segment of curriculum, and the date for reaching targeted proficiency. Objectives were then written that specified the weekly rate of progress necessary to meet goal proficiency. Experimental teachers then measured reading performance two times a week, using a 1-minute oral reading fluency passage. Following each measurement, teachers graphed student performance as the number of correct words read. Data decision rules were applied after 7 to 10 progress measurement points, with instructional changes being introduced when visual analysis indicated progress that appeared inadequate to reach goal criterion. Teachers in the control group set goals and monitored progress as they chose, which was reported as periodic use of teacher made-tests, observations, and workbook exercises.

Achievement of students in both teacher groups was measured before and after treatment using a passage reading test and at the end of the study using two subtests of a diagnostic reading assessment. Teacher decision-making was measured by observation three times during the study using a scale that measured structure of instruction, and by a questionnaire twice during the study on which teachers reported progress of students, changes made to goals, and students' present levels. In addition, a random sample of 30 students was interviewed at the end of the study about their progress and goals. Results of the study indicated that mean scores for students of teachers in the experimental (E) group were higher than students of teachers in the control (C) group on passage reading measures (E = 70.23; C = 51.29) as well as decoding (E = 39.79; C = 29.65) and comprehension measures (E = 43.95; C = 33.02). In addition, more students of teachers in the experimental group knew their goals, were able to state their goals, and could judge with accuracy whether they were on track to meet their goals. Teachers using DBPM procedures were more aware of student progress making them better able to adjust instruction, whereas teachers in the control group were uncertain, often overestimating their instructional effect on improved achievement.

Researchers found that teachers' use of DBPM procedures (i.e., objective measurement and evaluation with repeated CBM) resulted in more structured and varied instruction that, in turn, led to better student achievement and evidence of student learning than did teachers' typical unsystematic practices (Fuchs et al., 1984). These findings provided empirical evidence that DBPM procedures including the use of: a) frequent objective measurement using CBM for goal setting, data collection, organizing and graphing data; and b) frequent objective evaluation by applying data utilization rules, were not only feasible, but could be used routinely for DBIDM to improve student learning, and as a result, teacher effectiveness.

Formative evaluation. When teachers use DBIDM practices to plan, implement, and adjust instruction that is responsive to changes in student performance—as demonstrated by data collected during frequent, objective measurement of student performance—this is formative evaluation (Fuchs et al., 1984; Fuchs & Fuchs, 1986). Fuchs and Fuchs (1986) define systematic formative evaluation as an approach that (a) increases the achievement of students with mild disabilities, (b) includes the continuous measurement of student performance, and (c) includes regular evaluation of student performance in response to varied instructional procedures. Procedures developed through the DBPM approach as CBM, and applied by Fuchs et al. (1984), have since been implemented in the vast majority of special education research, establishing an evidence base for DBIDM practices. Some researchers have also extended the study of these practices into general education settings, with similar results.

In a meta-analysis, Fuchs and Fuchs (1986) investigated the effects of formative evaluation on student achievement across 21 studies. The studies were evaluated in terms of both methodological features (publication type, year, study quality) and substantive features (behavior modification, data display, data evaluation, grade level, disability status, frequency of measurement, treatment duration). Of the studies included in the meta-analysis, most studies were conducted with students with disabilities (83%) of which 98% were students with mild to moderate disabilities and 2% were students with severe disabilities. The median grade level, in the range from preschool to high school represented in the meta-analysis, was 3.8. Studies also included a range of subject areas either in isolation or combined with other subject areas, including: reading, math, spelling, writing, preschool skills, and high school content areas.

Researchers found that increases in student achievement, resulting from systematic formative evaluation, were similar across methodological and substantive features including: grade/age, disability, treatment length, and measurement frequency (Fuchs & Fuchs, 1986). On average, students with disabilities in instructional programs using systematic formative evaluation procedures achieved .7 standard deviations higher than students in programs not formatively monitored. Similarly, the achievement of students without disabilities was, on average, .63 standard deviations higher with teacher use of formative evaluation. Measurement of student performance twice a week had the largest effect size (.85), which was quite similar to the effect size of daily measurement (.69) – both of which were greater than measurement 3 times a week (.41). The gains in student achievement were greater for experimental treatments that lasted more than 10 weeks (.70), although treatments that lasted less than 3 weeks and 3-10 weeks produced gains over the non-use of formative evaluation with an effect size of .50. Some substantive features—data evaluation, graphing, and behavior modification—produced greater improvements in student achievement, therefore, suggesting their importance in formative evaluation. For example, effect sizes were greater when teachers included data-decision rules (.91), reviewed student progress at regular intervals, and introduced instructional adaptations as a result of data trends. In addition, effect sizes were greater when measurement data were graphed (.70) rather than just recorded (.26). Finally, student achievement was 1.2 standard deviations higher in studies including positive reinforcement for academic behaviors as part of formative evaluation, rather than only measurement and evaluation.

In a meta-analysis of studies of CBM in reading, Reschly, Busch, Betts, Deno, and Long (2009) found that, overall, the CBM Oral Reading measure (R-CBM) was a statistically significant, and strong predictor of students' performance on other standardized reading achievement tests (weighted $r = .67$), including both national tests and state-specific tests of reading standards. This correlation provides support for the use of this measure within general education, particularly for screening and identification purposes to determine if students are at-risk of not meeting proficiency on state assessments. Specifically, in comparison between state and national (group-administered) tests, R-CBM performance was found to be a statistically significant predictor of performance on state tests, $t(139) = 46.92$, $p < .001$; as well as for group administered national tests, $t(139) = 4.56$, $p < .001$. In addition, the correlation coefficient was higher for national tests (.74) than for state-specific tests (.65).

In a comparison of individual and group-administered national tests, R-CBM performance was found to be a statistically significant predictor of individually administered tests, $t(81) = 20.10$, $p < .001$; as well as for group-administered tests, $t(139) = - 4.59$, $p < .001$. The strength or magnitude of the prediction decreased for group administered tests, suggesting that individually administered assessments likely provide more reliable estimates. In addition, the correlation coefficient was higher for individually administered tests (.83) than for group-administered tests (.71). In a comparison of total reading score by grade, R-CBM performance was found to be a statistically significant predictor of reading outcomes for third grade students, $t(147) = 34.02$, $p < .001$. There was not a statistically significant difference found for first, second, fourth, and fifth grades. In a comparison of length of time, R-CBM was found to be a statistically significant predictor of reading skills when the criterion test was taken within the same academic year, $t(152) = 51.60$, $p < .001$; as well as across academic years, $t(152) = -3.58$, $p < .001$. The strength of the prediction decreased when the time span between R-CBM and criterion test increased, suggesting that as time increases between measurements the magnitude of the prediction decreases. In a comparison of individual and group administered reading subtest scores, R-CBM performance was found to be a statistically significant predictor of reading comprehension, $t(131) = 31.01$, $p < .001$. There was not a statistically significant difference found for vocabulary and decoding indicating that performance on R-CBM was related to vocabulary, decoding, and other reading skills just as much as comprehension. Although there was a statistically significant increase for the word identification subtest, $t(131) = 4.71$, $p < .001$. This suggested that R-CBM has a stronger relationship to word reading skills than comprehension, decoding, and vocabulary.

Following Fuchs and Fuchs' 1986 meta-analysis, a collection of studies conducted by Fuchs, Fuchs, and Hamlett (1989a, 1989b, 1990, 1991) further investigated technical features of CBM for formative evaluation. As a result of these studies, the adequacy of DBIDM practices (i.e., methods of using CBM for frequent measurement and evaluation) evolved and the evidence base was strengthened. Each of the 15-week studies was conducted with 30 special education teachers in self-contained and resource programs, across 16 schools in a southeastern metropolitan area and employed the use of computerized data management software. Overall, findings of the studies similarly demonstrated improvements in both student achievement and teachers' planning of effective instruction, in light of (a) dynamic goal setting within CBM (Fuchs, Fuchs, & Hamlett, 1989a), (b) instrumental use of CBM (Fuchs, Fuchs, & Hamlett, 1989b), (c) skills analysis within CBM (Fuchs, Fuchs, & Hamlett, 1990), and (d) computerized expert advice within CBM (Fuchs, Fuchs, & Hamlett, 1991).

Fuchs et al. (1989a) compared the effects of two goal structures, static (fixed) goals and dynamic goals. Teachers were assigned randomly to either the dynamic goal CBM group, static goal CBM group, or control group. Each teacher selected two student participants in grades 2-9 with goals in reading, spelling and math for the study. Teachers in the two experimental groups, dynamic and static, used CBM to assess student progress toward goals in math, half of which were administered and scored on a computerized data management software and the other half were administer by teachers, who then entered the scores into the same data software. Teachers used a list of goals and corresponding skill objectives assessed at each grade level to select appropriate year-end goals aligned with the state's math curriculum. Progress was monitored twice a week using a 2-minute probe that contained 36 problems matching the computation skills at goal level. Probes were scored for correct digits. Teachers determined students' baseline performance by administering three measures and using the median score as baseline. An estimated criterion for students' end of year performance was then set.

The computerized data software graphed student scores including an aim line (i.e., goal-line) to represent the desired slope or rate of progress over time from baseline to goal, and a regression line (i.e., trend line) to represent the observed slope or a line of best fit for rate of actual progress over time; applied data decision rules; and provided feedback on those decisions. Data were reviewed after 7-10 measurement points as in Fuchs et al. (1984), although rules and decisions were computerized. For teachers in the dynamic goal group, if the regression line was less steep than the aim line, the decision was to make an instructional change and collect 7 to 10 more assessments, then apply decision rules again It the regression line was as steep as the aim line, the decision was to collect additional data and reapply decision rules in 2 weeks. If the regression line was steeper than the aim line, the decision was to increase the goal to a criterion based on current rate of progress, collect 7-10 more assessments, then apply decision rules again. Once a student demonstrated the highest level of proficiency on the selected curriculum level, an additional decision included implementing CBM on the next grade level curriculum. For teachers in the static group, decision rules were the same unless the student performance was above the aim line, in which case the decision was to collect more data and reapply rules in 2 weeks (i.e., no changes were made to instruction or goal). The control group set goals and monitored progress as usual practice in special education, reported similarly by teachers in this study to those in Fuchs et al. (1984), as using unit tests, observation of performance, and worksheet performance.

Student achievement data was measured on a content mastery measure and a content coverage measure before and after the study. Additionally, the accuracy of teacher implementation was rated at week 10 of the study with additional implementation data collected after the study. Findings demonstrated that achievement gains for students of teachers in the dynamic goal (DG) group were greater than the static goal (SG) and control (C) groups (DG = 50.82, SG = 46.21, C = 42.02) with a .52 effect magnitude.

Additional findings indicated that teachers in both CBM groups implemented the procedures with accuracy. The dynamic goal group teachers initiated more goal changes for over half of their students in comparison to the static goal group, where only one teacher made a goal change for one student. Accordingly, the dynamic goal group had more ambitious goals than the static group at the end of the study. Researchers found that developing ambitious goals dynamically is important for increased student achievement and teacher recognition of student learning potential. In addition, findings suggested that teachers likely need prompting to increase student goals when data supports doing so.

Fuchs et al. (1989b) investigated the effects of each component of CBM—measurement and evaluation—on student achievement in reading. Teachers were assigned randomly to either an experimental CBM group or a control group, with each teacher selecting two students in grades 1-9 with reading goals for participation in the study. Teachers in the experimental group used CBM for goal setting, which included selecting the curriculum level for students' annual reading goals; measurement, which included assessment of reading performance two times per week, using recall or cloze measures; and evaluation, which included weekly review of reports from the computerized data software. The data software generated graphs of performance, applied data decision rules and provided feedback on resulting decisions within weekly reports as in Fuchs et al. (1989a). Some experimental teachers administered and scored the measures themselves, then entered the scores into the data software; other teachers used the software for both administration and scoring. After a practice period, the final three scores of the 12 initial measures were used to establish a baseline and goal criteria. The data software applied CBM decision rules, which compared a regression line (or trend line, representing the slope of observed progress) to the aim line (or goal line, representing the slope of expected performance) after 7-10 measurements. Computerized trend-based decisions included: a) to implement an instructional change and collect 7-10 additional measures for regression lines that were less steep than the aim line; and b) to raise the goal and collect 7-10 additional measures for regression lines steeper than the aim line. Teachers in the control group set goals, measured performance, and evaluated student performance using typical methods including unsystematic observation of performance and worksheet performance (Fuchs et al., 1984; Fuchs et al., 1989a, 1989b).

After 15 weeks, measurement (administering, scoring, and graphing) was distinguished from evaluation (an instructional modification that was introduced and maintained for 2.5 weeks) based on inspection of student graphs. Two student/teacher groups were created for comparison: CBM measurement only, which included 15 students and 9 teachers; and CBM measurement with evaluation (M+E), which included 21 students and 12 teachers. Student achievement was measured before CBM implementation using a standardized reading recall measure and after CBM implementation using a global reading comprehension measure, in addition to weekly progress monitoring. Results of the study indicated a statistically significant effect with achievement of students in the M + E teacher group greater than achievement of students in the control (C) group (M + E = 577.35, C = 538.99) with an effect magnitude of .72. The measurement only group was greater than the control group, but not reliably different on the achievement measure. In addition, a statistically significant effect was demonstrated on weekly CBM, for the M+E group (Mean = .40). The slope of improvement surpassed that of the measurement only group (Mean = .03), with an effect magnitude of .86. Researchers found that it was essential for teachers not only to measure student performance, but also to use those indicators to evaluate instructional effectiveness and experiment with instructional adjustments. Findings suggested that using data in this way for instructional planning (i.e., formative use of data) allowed teachers to maintain elements of instruction that were effective while removing elements that were not.

Fuchs et al. (1990) examined the effects of skills analysis within CBM on further improving instructional planning and student achievement. Teachers were randomly assigned to either (a) the CBM with performance indicator and skills analysis (P + S) group, (b) the CBM with performance analysis only (P) group, or (c) the control (C) group. Each teacher in the CBM groups chose four student participants with math goals for the study, while teachers in the control group selected two students with math goals to participate. All student participants were in grades 3-9

The control group set goals as usual with standard IEP forms. This mirrors the traditional methods reported by teachers in earlier studies (Fuchs et al., 1984; Fuchs et al., 1989a, 1989b) including unit tests, unsystematic observation of performance, workbook and worksheet performance. Teachers in both CBM groups used a list of goals and corresponding skill objectives assessed at each grade level to select appropriate year-end goals aligned with the state's math program. Progress was monitored twice a week using a 25-item probe that contained problems matching the computation skills at goal level, which ranged from grade 1-6. Probes were scored for correct digits within two minutes for grades 1-3, three minutes for grade 4, and 4 minutes for grades 5-6. Although teachers were trained to administer and hand score measures, students completed computerized

CBM tests within a data management software system that collected, scored, and stored assessment results. In the same manner as earlier studies (Fuchs et al., 1989a, 1989b), teachers determined students' baseline performance and set criterion for year-end performance. The data software automatically analyzed CBM performance indicators: graphed scores, applied data decision rules, provided feedback on decisions, and performed a skills analysis of student responses. Decision rules in this study were the same as in Fuchs et al. (1989a, 1989b), although data were reviewed after 8 data points rather than a range of 7-10 points (Fuchs et al., 1984; Fuchs et al., 1989a, 1989b). The additional skills analysis component included in this study consisted of a mastery status for each objective, as well as a history of objective mastery levels. The mastery status marked each objective as (a) not attempted (0% of problems attempted), (b) non-mastered (less than 75% attempted with less than 85% accuracy or at least 75% attempted with less than 40% accuracy), (c) partially mastered (less than 75% attempted with at least 85% accuracy or greater than 75% attempted with 40-85% accuracy), and (d) mastered (at least 75% attempted with at least 85% accuracy). The objective history provided mastery levels for each objective type, at half-month intervals, which were color coded to indicate levels of mastery.

Student achievement was measured before and after the study. In addition, teacher fidelity of implementation was measured during the 10th week of the study for two students per teacher. Following completion of the study, program development was also measured, including: number of goal changes; ambitiousness of goals; number of instructional changes introduced; and number of specific math skills referenced in instructional changes. Results indicated that performance of students in the CBM with performance indicator and skills analysis (P + S) group exceeded that of students in the CBM with performance indicator only (P) group and the control (C) group, with an effect magnitude of .67 (P+S = 8.98, P = -2.15, C = -6.83). In addition, teachers in the P+S group planned more specific instruction in comparison to teachers in the P group. Study findings supported that, as demonstrated in earlier studies (Fuchs et al., 1984; Fuchs et al., 1989a, 1989b), CBM performance data positively impacted both instructional planning and student achievement. Fuchs et al. (1990) suggested that in addition to performance indicators only, skills analysis further improved teacher's ability to target specific skills for instructional changes. An interesting finding in this study included the lack of difference between the P group and the control group, which suggested that teacher use of automatic data might not provide the opportunity to see or inspect student responses. Researchers assert this finding makes skills analysis even more essential when teachers use computer based CBM systems, rather than administering and scoring assessments by hand (Fuchs et al., 1990).

Fuchs et al. (1991) conducted a study with specific focus on an element of support included in previous study designs—the extent to which teachers received support from research staff (Fuchs et al., 1984; Fuchs et al., 1989a, 1989b, 1990). To provide information on the nature and type of supports teachers need, this study investigated the effect of computerized expert system advice on both teacher instructional planning and student achievement. Teachers were randomly assigned to one of three groups (a) CBM with expert system advice (CBM-ES), (b) CBM with no expert system advice (CBM-NES), or (c) control (no CBM). Each teacher selected two students, in grades 2-8, with current spelling goals for study participation.

Control group teachers used typical procedures for monitoring progress and providing instruction including similarly reported assessment types in previous studies (Fuchs et al., 1984; Fuchs et al., 1989a, 1989b, 1990), as well as systematic monitoring, standardized achievement tests, and criterion-referenced tests. Teachers in both CBM groups used professional judgment to determine curriculum and set student year-end goals, although guidance on typical rates of progress (one letter sequence [LS] per week) was provided. Baseline performance was determined as in previous studies (Fuchs et al., 1989a, 1989b, 1990). Progress was monitored at least twice a week, during which words were said aloud and students had 16 seconds to type the word on the computer. In departure from the pattern of review seen in earlier studies (Fuchs et al., 1984; Fuchs et al., 1989a, 1989b, 1990), data were reviewed each week at which time teachers used expert system software to graph scores, apply decision rules, and receive feedback on decisions and a skills analysis of student responses.

In addition to more frequent data review, the software applied data point decision rules in addition to trend-based decision rules. A four-point decision rule was applied if four consecutive data points were below the goal/aim line, prompting the decision that an instructional change was needed; or above the goal/aim line, prompting the goal needed to be raised. If the four-point decision rule had not prompted a change in instruction or goal level, after eight data points or measures, then trend-based data decision rules for comparing slopes, used in previous studies (Fuchs et al., 1989a, 1989b, 1990), were applied. In addition to the decision rules applied to performance indicators, the expert system generated a skills analysis report, including (a) a ranked list of the 60 most recent words spelled by percentage of LS; (b) words categorized as correct (100% LS), near misses (60-90% LS), moderate misses (30-59% LS), and far misses (< 29% LS); (c) up to three spelling pattern rule error types for each incorrect word; and (d) frequency of all spelling error types, with the three most frequent student error types identified. Teachers in both CBM groups were required to make instructional changes when necessary according to decisions rules, but teachers without the expert system (CBM-NES) determined the nature of change on their own, while teachers with the expert system (CBM-ES) relied on computerized advice. The expert system prompted CBM-ES teachers to provide information about student performance, errors, and previous instructional features. The system then used teacher input in order to formulate a recommendation and directions for implementation that included one to two instructional procedures such as direct instruction, mnemonics, and drill and practice; and if appropriate, strategies for motivation and task completion.

Teacher fidelity was measured during the 10th week of the study for one student per teacher; and the number of measurements (from system files that stored scores), expert system interactions (from system log files), and number of recommendations implemented (from teacher maintained instructional plan sheets) were counted after the study. Student achievement was measured before and after the study. For students in the CBM groups, student fidelity with computer CBM was measured at week 12; and understanding of graphed feedback was measured before and after treatment. Program adjustments were counted for each student after the study, including the number of goal increases, the level of goal ambitiousness, and the number of instructional adjustments. The nature of instructional programs was also coded after the study from Instructional Plan Sheets including information about instructional procedures, arrangement, time, materials, and motivational strategies for initial instruction and at each initiation of instructional change.

Results of the study indicated a statistically significant treatment effect, demonstrating that achievement of students in the CBM-ES group (Mean = 256.56) and the CBM-NES group (Mean = 262.60) were comparable, with achievement in both CBM groups being greater than that of the control group (Mean = 238.34). Findings also indicated strong implementation fidelity for both CBM groups and supported findings related to instructional planning in previous studies such as frequent goal increases (Fuchs et al., 1989a), and frequent instructional adjustments (Fuchs et al., 1984). An interesting finding in particular was that expert system advice did not impact greater achievement. Teachers in the CBM-ES group tended to use more drill and practice, which was only one of many instructional recommendations provided, while teachers in the CBM-NES group tended to use more teacher-directed instruction as they focused on skills analysis information. Researchers asserted that these results support earlier findings including teachers' need for technical assistance to ensure fidelity including both accurate CBM implementation (Fuchs et al., 1984) and being faithful to decision rules (Fuchs et al., 1989a, 1989b, 1990); and the need for skills analysis as part of measurement feedback to provide teachers with descriptive information of student needs for planning effective instruction (Fuchs et al., 1990).

While the efficacy of special education teachers' use of CBM for making instructional decisions on an individual student level has been well supported, fewer studies demonstrated the effects of this methodology in the general education setting. Fuchs, Fuchs, Bishop, and Hamlett (1992) described their research efforts for extending

CBM to more class-wide decision-making for improvement in math instruction and achievement in the general education setting. An experimental study was conducted across 40 classrooms with teachers randomly assigned to one of three groups (a) CBM with class-wide reports including descriptions of student performance, (b) CBM with class-wide reports including descriptions of student performance and recommendations for how to use this information for instruction, and (c) control. CBM was used with all students, grades 2-5, in each of the classes over a 9-month period.

For class-wide decision-making using CBM in the general education setting, the researchers developed and tested strategies to make the process more feasible for larger numbers of students, including (a) administering CBM, each of which included 25 problems, once a week for 1-7 minutes (with time depending on grade level); (b) whole-class CBM administration, then having students individually enter items at the computer afterwards or individual computer administration; and (c) using computer-managed data software for scoring probes (total number of correct digits), tracking student mastery over time, providing student feedback, and for teacher feedback on class-wide performance with instructional recommendations. Feedback on class-wide reports, provided by the data software twice a month, included a class graph, a list of students below the 25th percentile, skills that had improved or remained the same over the month, recommended skills appropriate to teach the whole class, and suggestions for providing small group instruction (Fuchs, Fuchs, Bishop, & Hamlett, 1992).

Researchers found that teachers in both experimental groups were able to use CBM with accuracy and reported satisfaction with the process. Greater gains in student achievement were seen for students whose teachers received instructional recommendations. In addition, instructional plans of teachers who received instructional recommendations included more research-based instructional methods such as class-wide peer tutoring, computer assisted instruction, one-to-one instruction, and systematic reinforcement. An interesting finding in this study was that the benefit in student achievement was evident for both low and average achieving learners. Study findings suggested that general education teachers might need advice for class-wide decision-making, which is similar to findings with individual decision-making in special education, across all content areas (Fuchs et al., 1984; Fuchs et al., 1989a, 1989b, 1990, 1991).

This research literature provides an evidence base for teachers' DBIDM practices, in both general and special education settings, that includes frequent measurement and evaluation with CBM for monitoring student progress within the curriculum and towards grade level standards. In addition, researchers in these studies have demonstrated the benefit of computerized CBM data software and technical assistance from research staff, which includes instructional recommendations, to teachers' DBIDM practices. These practices have been shown to provide an opportunity for teachers to individualize instruction in ways that improve student learning and teachers' instructional effectiveness, both of which are relevant to the more current focus in all of education on using data as the basis for decision-making.

Data-driven decision-making. Much of the more recent educational literature focuses on the use of data to support decision-making in a larger context of the state, district, and school under the term data-driven decision-making (DDDM; Mandinach et al., 2006; Marsh et al., 2006). Most literature surrounding DDDM focuses on implementation, rather than effectiveness, in the broad context of the education system and school culture. Variations are expected across the classroom, school, and district levels in (a) types of data collected, (b) analyses performed, c) decisions made, and (d) conditions for decision-making including interpretations (Mandinach et al., 2006; Marsh et al., 2006).

Mandinach, Honey, and Light (2006) developed a conceptual framework for DDDM, as part of a project sponsored by the National Science Foundation, that represents what being data-driven means for education stakeholders in classrooms, schools, and districts. The model describes a continuum from data, to information, to knowledge, including six crucial steps that include either cognitive skills or actions. In the data phase, action steps include the collection of appropriate data that answers a specific question and organization of the data in a systematic way to make sense of the data. In the information phase, steps include analysis to examine results or trends in a way particular to the question, and summarization of the collected information that can be used in remaining steps. In the knowledge phase, steps include the synthesis of information and prioritization of the importance of need. From this process, a decision is implemented and the implementation then results in an outcome. Depending on the outcome, the need to return to one of the six action steps within the continuum may arise; therefore the process is described as iterative (Mandinach et al., 2006).

The all-encompassing nature of DDDM and general explanation of the process for data use described in the related literature has not been directly connected to the evidence base for DBIDM practices established through earlier special education research. However, the cycle of data collection, organization, and evaluation to make decisions that can be implemented and further evaluated for effects on student learning outcomes are common processes described across DBPM, CBM, formative evaluation, and DDDM. Such systematic processes have become increasingly important as part of more recent large-scale school-reform initiatives for meeting standards-based accountability requirements. MTSS for instance, is one of many widely implemented school improvement initiatives intended to help all students reach proficiency on rigorous standards, as a result of high-quality instruction that meets students' varying learning needs.

Multi-tiered system of support. MTSS models provide a "comprehensive framework for continuous school improvement that uses ongoing measurement, monitoring, and evaluation of standards implementation and outcomes to drive data-based decision-making" (p.7, Hayes & Lillenstein, 2015). MTSS models promote DBIDM practices to address students' individual academic needs in a school-wide framework of prevention-intervention that includes four essential components (a) a multi-level prevention system, (b) screening, (c) progress monitoring, and (d) data-based decision-making. By providing instruction and intervention within varying tiers, the aim of MTSS models is to provide increased opportunities for students to receive instruction that meets their varying needs and improve their proficiency of skills within rigorous curriculum standards (Hayes & Lillenstein, 2015). A MTSS creates a continuum of supports across the school setting in which educators are responsible for providing standards-relevant instruction and monitoring student progress at each level of the model.

The emphasis in such models is placed on effective core instruction for all learners in the general education classroom, making it essential that teachers provide instruction that is research-based, designed to meet diverse student needs, and to incorporate motivation strategies and periodic assessment to identify students in need of additional support in the general education setting (Hayes & Lillenstein, 2015; National Center on Intensive Intervention [NCII], n.d.). The screening component within an MTSS aids in early identification of students with learning and behavior difficulties despite solid core instruction. Additional supports can then be provided as needed for identified students through increasingly intensive interventions that match students' individual needs, with decisions based on progress monitoring data. Therefore, in order to implement a successful MTSS model, general education teachers must have the skills to monitor student progress, analyze data, and adapt and individualize instruction (Hayes & Lillenstein, 2015).

Hayes and Lillenstein (2015) asserted that when school improvement initiatives are implemented without coherence, mixed signals are sent to practitioners about instructional practices. For instance, teachers are currently guided in what to teach by state curriculum standards for college and career readiness, such as Common Core State Standards. Teacher effectiveness is also currently evaluated in light of student proficiency on grade-level standards. MTSS, therefore, can serve to bridge standards-based accountability and teacher evaluation, by guiding teachers in how to teach by structuring high-quality instruction with additional supports as needed (Hayes & Lillenstein, 2015). When implemented in a coherent fashion—where practices evaluated within a teacher evaluation system align with standards-relevant instructional practices, and instructional practices within an MTSS model are evidence-based with proven effectiveness for at-risk learners—the potential for positive impact on both instructional practices and student learning can be actualized (Hayes & Lillenstein, 2015).

Implemented in over 70% of school districts nationally, RTI is one of the most widely used MTSS models for addressing academic instruction and support (Hoover & Love, 2011). The systematic process within RTI and similar MTSS models for decision-making at both the class-wide and individual student level parallels both the DBIDM practices developed within DBPM and CBM for formative evaluation and the inquiry cycle suggested within DDDM.

Response to intervention. RTI incorporates the four essential components of an MTSS model to facilitate a systematic cycle of data collection and evaluation. RTI is a school-wide prevention-intervention framework designed to guide the use of screening and progress monitoring data as the basis for making instructional decisions, evaluating a student's response to generally effective instruction, and providing increasing levels of intensive support when a student's response to instruction is poor in comparison to peers (NCRTI, 2010; Stecker et al., 2008). While the essential components of RTI have been defined, schools make decisions in accordance with SEA and LEA regulations, as well as expert recommendations, about the procedural dimensions of their model. These features include (a) the number of tiers, (b) how to target students for preventative interventions, (c) the nature of interventions, (d) how to classify responsiveness to instruction, (e) the nature of multi-disciplinary evaluation prior to special education referral, and (f) the function and design of special education within the RTI model (Fuchs & Fuchs, 2006; NCRTI, 2010).

Tiered instruction and intervention. Schools determine the structure of their multi-tiered prevention system by determining the number of tiers the RTI model will include. Some RTI models include only one level of intervention and others include two levels (Fuchs & Fuchs, 2006). Experts recommend, however, that RTI models have three tiers, with only one level of support separating general and special education in the continuum of services, in order to prevent intervention services from being used as special education, and to ensure students in need of special education services are appropriately identified (Fuchs & Fuchs, 2006; Johnson et al., 2006). Within all RTI models instruction and intervention is provided with increasing intensity within each tier (e.g., Tier 1, Tier 2, Tier 3) or level of support (e.g., primary, secondary, tertiary; Fuchs & Fuchs, 2006; Johnson et al., 2006).

The general education classroom is considered the first tier (level) , in all RTI/MTSS models, through which all students are provided core instruction in the general education curriculum. Core instruction within Tier 1 should be research-based, differentiated, and implemented with fidelity (Stecker et al., 2008). General education teachers assume responsibility for providing this instruction, which is generally effective for the majority (approximately 80%) of students (Johnson et al., 2006).

As is expected within Tier 1, instruction at Tier 2 of RTI should be evidence-based, designed to meet students' diverse learning needs, and implemented with fidelity (Stecker et al., 2008). In Tier 2, students' targeted skill needs are addressed in addition to the instruction received in Tier 1, through (a) instructional procedures that are more teacher-directed, systematic, and explicit; (b) more frequent targeted instruction; (c) increased time for targeted instruction (i.e., duration of sessions); and (d) targeted instruction delivered in small groups of students with similar needs (Fuchs & Fuchs, 2006; Stecker et al., 2008). Tier 2 instruction is most often necessary for a smaller group of students (approximately 15%) and provided by the general education teacher, although in some schools this level of instruction may be provided by specially trained interventionists or support staff if resources are available (Johnson et al., 2006).

In most RTI models, if a student continues to demonstrate a poor response to a combination of core instruction at Tier 1 and multiple attempts for implementing effective instruction and interventions at Tier 2, they are considered for the next level of supports at Tier 3, or special education services (Stecker et al., 2008). In Tier 3 (generally necessary for only about 5% of students) students receive intensive and individualized instruction/remediation carried out by a special education teacher. This level of instruction is provided in addition to core instruction, including necessary accommodations and modifications within the general education setting relative to students' individual needs within the general curriculum (Johnson et al., 2006). Instruction within Tier 3 of RTI, or special education, is defined as "specially designed instruction that meets the unique needs of students with disabilities" (p.57, Johnson et al., 2006). In earlier special education research studies, teachers were provided with instructional recommendations for implementing effective instructional procedures for students with disabilities, such as direct instruction, mnemonics, drill and practice, class-wide peer tutoring, computer assisted instruction, one-to-one instruction, and systematic reinforcement (Fuchs et al., 1992; Fuchs et al., 1991). Similarly, recent recommendations for Tier 3 instruction also include approaches with evidence supporting effectiveness for at-risk learners, including those with SLD (e.g., direct instruction in combination with strategy instruction; Johnson et al., 2006).

Approaches to tiered instruction and intervention. Schools must also determine the approach that will be taken within the RTI model: problem solving, standard treatment protocol, or a combination of the two approaches (i.e., hybrid). A problem solving approach follows a standard four-step process, through which assessment and intervention is tailored for each individual student (National Center on Response to Intervention [NCRTI], 2014). In this approach instruction and intervention can vary from student to student, with evidence-based accommodations or modifications made to existing curriculum based on each students' targeted needs (Johnson et al., 2006). Such an individualized approach requires that practitioners have proficient knowledge of various assessment and intervention types; and the opportunity to measure and evaluate the effectiveness of those implemented as part of a student's intervention plan (Fuchs & Fuchs, 2006). A standard treatment protocol approach, however, is specified, and therefore regarded by researchers as representative of what typically works to benefit most students; and easier to train, implement, and monitor within schools and districts (Fuchs & Fuchs, 2006; Fuchs & Fuchs, 2006). In this approach, each student receives the same research-based instructional intervention as designed (sometimes even scripted), for a specific amount of time (e.g., 10 weeks) after which student performance is assessed to evaluate the student's response to the intervention treatment (Fuchs & Fuchs, 2006; Johnson et al., 2006; NCRTI, 2014). This approach allows for schools and districts to select an instructional program to remediate a specific skill and group students that have similar targeted, skill-based needs for intervention (Johnson et al., 2006). In some RTI models, schools decide to use a combined approach. At times, schools may opt to use elements of both approaches for a comprehensive framework to address both academic and behavioral concerns. Alternatively, schools may implement both approaches consecutively, in which a standard treatment protocol occurs initially to remediate a specific academic skill (e.g., at Tier 2) followed by the use of problem solving when or if data demonstrates the need to further individualize or modify interventions (e.g., at Tier 3; Johnson et al., 2006).

Assessment within tiered instruction and intervention. The design of school-developed models systematically guides teachers' DBIDM practices within each tier as leaders establish school-wide assessment components including (a) assessment systems for screening and progress monitoring, and (b) standard decision criteria and rules (Fuchs & Fuchs, 2006; Johnson et al., 2006; Fuchs, 2003). In a RTI Manual developed to provide comprehensive guidance for schools and districts as they develop and implement RTI models, Johnson, Mellard, Fuchs, and McKnight (2006) asserted that schools must adopt an assessment system for measurement during screening and progress monitoring within designed RTI models. Schools may choose to adopt a screening tool for annual universal screening. However, the more frequently academic behaviors are measured throughout the year on these samples, the more sensitive data becomes to demonstrating changes in performance as the year progresses (Fuchs et al., 1992). Therefore, more proactive assessment models include screening that occurs at least three times a year, using CBM for universal screening and benchmark progress monitoring in reading and math in Tier 1 (e.g., Monitoring Basic Skills Progress, Dynamic Indicators of Basic Early Literacy Skills [DIBELS], Intervention Central CBM probes; Johnson et al., 2006). In

Tier 1, these assessments provide data to inform DBIDM at both the class-wide level (e.g., making instructional and curricular changes) and the individual student level (e.g., identifying students in need of additional instructional supports and intervention in Tier 2; Johnson et al., 2006).

When a student is determined at-risk and in need of Tier 2 interventions during screening or benchmark progress monitoring, assessment becomes increasingly important and occurs more frequently. Frequent progress monitoring within Tier 2 and beyond can be used to determine whether interventions are successful in improving student learning, which guides making adjustments to instruction and intervention at the individual student level, movement between tiers, and eligibility decisions (Johnson et al., 2006). Johnson et al. (2006) assert that the data collected during RTI progress monitoring in Tiers 1 and 2 can be used in addition to data from other assessments collected in the evaluation for special education services to document the provision of appropriate instruction in the general education setting, and the potential presence of a SLD due to lack of response to increasingly intensive and targeted instruction and interventions implemented with fidelity. A student determined to have a SLD will receive special education services (Tier 3 in most RTI processes) during which data from frequent progress monitoring can be used to describe present levels of performance, and to develop goals as the student's Individualized Education Program is written (Stecker et al., 2008).

In addition to its use for screening and benchmarking, CBM is also suggested for frequent progress monitoring in Tier 2 and beyond (Johnson et al., 2006). An alternate form of the same measure should be used to observe the target behavior each time. In this way, repeated measures on alternate forms can be used to demonstrate growth in overall proficiency within the annual curriculum (Deno, 1992; Stecker, Lembke et al., 2008). Wayman, Wallace, Wiley, Ticha, and Espin (2007) suggested that read-aloud CBM measures including word identification measures for beginning readers, oral reading fluency measures for primary levels, and maze comprehension measures for upper-elementary and secondary levels have produced positive empirical results as overall reading proficiency indicators and are useful in predicting performance on statewide reading assessments. Whereas an indicator approach may be more useful in reading, a curriculum sampling approach to progress monitoring may be essential for math because the scope and sequence of math skills build both within a grade level and across grade levels (Foegen, Jiban, & Deno, 2007). Foegen, Jiban, and Deno (2007) suggested that as schools and teachers select curriculum sampling measures for progress monitoring in math, that they ensure the content of the measure matches content from their curriculum. Regardless of the particular measure selected for school use within RTI, teacher fidelity in terms of progress monitoring procedures is very important (Johnson et al.2006; Stecker, Lembke et al., 2008). Stecker, Lembke et al. (2008) suggest that fidelity with progress monitoring includes ensuring the consistent use of measurement materials, directions for administration, timing, and scoring.

Johnson et al. (2006) stated that schools must also clearly establish standard criteria and rules for making decisions about placement and movement within RTI models. These criteria and decision rules guide data interpretation and decisions during screening and benchmark progress monitoring for identifying students at-risk; and during progress monitoring for determining if a student is responding adequately to instruction and/or interventions being provided (Johnson et al., 2006). Hoover and Love (2011) suggested that not only do schools need to determine decision criteria but also to train teachers so that they can successfully implement DBIDM within each tier.

Decision-making criteria commonly combined to create a school's decision rules include (a) level (cut score/benchmark), (b) gap analysis (size of discrepancy), (c) growth (rate of progress/slope), and (d) a combination of level and growth (dual-discrepancy). In considering level criteria, a predetermined cut score or benchmark proficiency score on an assessment measure's scale represents the division between students who are at-risk and those students who are not (e.g., below the 25th percentile targets potential at-risk students and those in need of more intensive intervention; Hoover & Love, 2011; Johnson et al., 2006; NCRTI, 2010). Gap analysis involves consideration of the size of discrepancy between a student's observed performance and expected performance (e.g., larger gaps demonstrating need for more intensive intervention; Hoover & Love, 2011). Growth criteria call for comparing expected rates of progress to actual rates of progress, with students demonstrating lower (i.e., slower) rates of progress identified as needing more intensive intervention to accelerate learning progress (Hoover & Love, 2011; Johnson et al., 2006). Of each of the decision criteria described in the literature on RTI implementation, experts tend to most commonly recommend decision rules based on both level and growth (i.e., dual discrepancy) for accurate and timely decision-making across all tiers. These rules consider both a student's performance level and their rate of growth and can be applied at any time before, during, or following intervention (Hoover & Love, 2011; Johnson et al., 2006; Fuchs, 2003; McMaster, Fuchs, Fuchs, & Compton, 2002; Stecker et al., 2008).

Protocol of data use within tiered instruction and intervention. Planning and implementation guidance for RTI models cite special education research as the research-base for recommended practice. For this reason, suggested practice includes a protocol including the use of CBM for formative evaluation.

In Tier 1 of RTI, through school-wide screening and formative benchmarking, the progress of all students is monitored at regular intervals (e.g., at the beginning, middle and end of the year) on academic skills within the curriculum. Fuchs et al. (1989b) suggested that this frequency of measurement can be utilized for eligibility decisions in the same way these measures are suggested for use in RTI, to target students in potential need of intervention and identify students at-risk. By comparing students' measured performance at each of these intervals to either norm-referenced cut scores or criterion-referenced benchmarks (i.e., rates of progress necessary to meet end of year proficiency) general education teachers can determine if students are above, at, or below the expected level of proficiency (Fuchs & Fuchs, 2006). Students falling below benchmark/cut score are identified as potentially at-risk, meaning that they may need additional supports to be successful in the general curriculum. At this point, teachers continue to provide core instruction in the general education classroom that is evidence-based, ensuring that instruction is being appropriately differentiated. Experts recommend that teachers should also begin measuring the progress of these students more frequently (i.e., weekly) for the following 5-8 weeks, as students may demonstrate improvements without additional supports and this could prevent them from being placed unnecessarily in the next level of support (Johnson et al., 2006; Stecker et al., 2008). If after eight weeks, data from progress monitoring demonstrates a dual discrepancy (i.e., the student is still performing both below benchmark and progressing at a slower rate than their peers), the learner is defined as non-responsive to the core curriculum provided at Tier 1 (Fuchs & Fuchs, 2006a; McMaster et al., 2002).

When a student does not respond to core instruction at Tier 1, this indicates the need for instruction and interventions designed to accelerate the student's rate of progress, and decrease the discrepancy between the student's measured and desired performance. In RTI, this is described as secondary supports at Tier 2, which students receive in addition to the core instruction at Tier 1. In Tier 2 of RTI, long-term goals must first be set that direct (a) the materials and conditions used for measurement, (b) the observed behavior during measurement, and (c) how attainment of the goal will be determined (Fuchs et al., 1989a). Teachers can use a list of goals and corresponding skill objectives assessed at each grade level to select appropriate year-end goals aligned with state curriculum in the area in which a student has demonstrated difficulty. The area of curriculum and grade-level for annual goals are specified as the materials on which student performance will be measured (e.g., on a third grade reading passage or on fourth grade computation problems; Fuchs et al., 1984; Fuchs, et al., 1990). The target academic behavior is defined as observable and measurable in relation to the segment of curriculum (e.g., number of correct words read or number of correct digits computed; Fuchs et al., 1984; Fuchs et al., 1989a, 1990). To establish a baseline of student performance, three goal-level measures are administered and scored, and then the median (middle) score is used as the current level of performance (i.e., baseline; Fuchs et al., 1989a, 1989b, 1990; Stecker, Lembke et al., 2008). The long-range or end-of-year benchmark relative to the curriculum is used as the criterion for goal attainment (Stecker et al., 2008).

According to Johnson et al. (2006) and Stecker et al. (2008), research-based recommendations for measurement and evaluation within Tier 2 of RTI and beyond include (a) progress monitoring one to two times per week that is evaluated for 8-15 weeks, (b) scores from progress measures being graphed and analyzed regularly, and (c) standard decision rules being used for evaluating adequate response to intervention. As progress measures are administered, they should promptly be scored and the results should be graphed to organize data for evaluation. This not only offers teachers the opportunity for frequent visual analysis and evaluation of trends, but also provides visual feedback to students about their performance, and can be useful for communicating performance to colleagues and parents (Deno, 1992; Fuchs & Fuchs, 1986; Hosp & Hosp, 2003). Graphed data displays include data points for the baseline, each measurement, and end of year criteria (Hosp & Hosp, 2003). A goal or aimline is drawn to connect the baseline data point to the goal criterion data point to represent the necessary rate of progress for attaining year-end goals (Deno, 1992; Stecker et al., 2008). While teachers themselves initially created graphed data displays by hand (Fuchs et al., 1984) computer software is now more commonly used (Fuchs et al., 1992; Fuchs et al., 1989a, 1989b, 1990, 1991).

Data utilization or decision rules provide a means for explicit and systematic evaluation of graphed data. Earlier special education research helped to establish research-based decision rules including those that are based on trends, data points, or a combination of the two. Trend-based decision rules require a comparison between the slope of a student's performance and the goal or aim line. Instructional changes are prompted by three decision rules: (a) if the slope is less steep than the aim line, an instructional change is introduced, progress continues to be monitored, and data decision rules are applied after eight measurements; (b) if the slope is as steep as the aim line, instruction is continued without change, progress continues to be monitored, and is checked again in two weeks; and (c) if the slope is steeper than the aim line, the goal is raised, instruction is continued without change, and progress continues to be monitored with rules being applied after eight measurements (Fuchs et al., 1989a, 1989b, 1990). Data point decision rules indicate that if four consecutive points (within eight measurements) are below the goal line, then an instructional change must be introduced; and above the goal line, then the goal must be raised (Hosp & Hosp, 2003). When used in combination, data-point rules are initially applied. If after eight measurements, the 4-point rule has not prompted a change in instruction or goal, then rules for comparing slope should be followed (Fuchs, et al., 1991). These data-point decision rules are the current research-based recommendations for use within Tier 2 of RTI, particularly in conjunction with CBM use for progress monitoring (Hosp & Hosp, 2003; Johnson et al., 2006).

In addition to goal increases, instructional responses prompted by data decision rules include aspects or features of instruction that can be adjusted including instructional procedures, arrangement or size of instructional grouping, time allowed for instructional procedures, materials used during instruction, and motivational strategies (Fuchs et al., 1989a, 1991; Stecker, Lembke et al., 2008). School-wide standard rule application within RTI, particularly at Tier 2, allows for timely and accurate decisions (a) to continue current instruction/interventions, (b) to modify or change current instruction/intervention, (c) to intensify current instruction/intervention (e.g., with movement to Tier 3), or (d) discontinue current instruction/intervention (e.g., with movement back to Tier 1; Johnson et al., 2006). Decisions for making instructional change, and/or movement within the RTI tiers, can be implemented, monitored, and evaluated in this manner for producing desired improvements in student achievement. As the instructional plan or intervention nears its end, outcomes can also be evaluated to determine if the discrepancy between a student's actual and expected performance was reduced to the point it is no longer a problem in learning, or if additional supports are necessary.

In the literature, researchers suggest that the success of all tiered systems relies on the validity of the measurement, evaluation, and strength of the interventions found in the first tier – from which the model's supports build in intensity and individualization. Teachers' DBIDM practices for measurement and evaluation should, therefore, parallel those with evidence of demonstrated effectiveness in improving instructional practice and student achievement of academic skills. In addition, because the literature suggests that general education teachers provide instruction that should be effective for 80% to 95% of students within Tiers 1 and 2 of RTI, general education teachers' DBIDM practices are critical to appropriate placement decisions, fluid and timely movement within and between levels of the multi-tiered system, and ensuring that instruction is effective in meeting students' diverse learning needs within implemented RTI/MTSS models (Stecker et al., 2008).

To summarize, in the RTI framework and similar MTSS models, emphasis is placed on instructional supports and services provided on a continuum between general and special education settings, which drive DDDM school-wide. Students' placement and movement along that continuum in RTI is based on frequently assessed achievement and learning needs within the general curriculum, much like the underlying principles of the DBPM approach. The historical foundation of teachers' formative data use was established and operationalized in earlier special education research literature surrounding procedures developed as CBM. In related studies, teachers applied formative evaluation using CBM across various content areas, demonstrating gains in student achievement, and teacher planning/provision of effective instruction. In the majority of these studies, computerized CBM data management software was used and technical assistance was provided through training and follow-up supports from research staff. Therefore, the results can only be generalized in settings with similar conditions. Despite this limitation, these studies laid the groundwork for further research, and development for scaling-up and sustaining teacher data use practices including frequent and objective measurement and evaluation. Such DBIDM practices are not only relevant but also essential to current large-scale school improvement initiatives, such as RTI/MTSS.

Impact of Applying Data-Use Procedures

The findings described by researchers in earlier special education literature support that DBIDM improves the quality of instruction, which in turn affects greater improvements in achievement for students with and without disabilities in both general and special education settings. While measurement of student performance alone has not been proven to affect improved student achievement, both measurement and evaluation together has (Deno & Mirkin, 1977; Fuchs et al., 1984; Fuchs et al., 1989b). Teacher use of CBM as part of formative evaluation has resulted in higher student achievement in reading, math, spelling, and writing. Student achievement has been improved by teachers' use of measurement data during evaluation including quantitative performance indicators (Fuchs et al., 1984; Fuchs et al., 1989a), descriptive skills analysis in addition to performance indicators (Fuchs et al., 1990), and quantitative and descriptive performance feedback with instructional recommendations (Fuchs et al., 1992; Fuchs et al., 1991).

Teachers using DBIDM—including frequent progress monitoring and evaluation with CBM—were shown to be more structured in their instruction, more aware of and responsive to student progress, and better able to describe a student's present level and revise goals accordingly for varied instruction (Deno, & Mirkin, 1977; Fuchs et al., 1984). Teachers' instructional planning has been shown to include frequent goal increases and frequent instructional adjustments (Fuchs et al., 1984; Fuchs et al., 1989a, 1991). By setting more ambitious goals in response to student progress, teachers not only improved achievement, but also became more aware of student potential for learning (Fuchs et al., 1989a). Using skills analysis in addition to performance feedback from CBM data, teachers were better able to target specific skills as they planned, implemented and adjusted instructional elements (Fuchs et al., 1990).

More current special education literature includes similar supports for DBIDM practices that improve instructional effectiveness and efficiency. Sealander, Johnson, Lockwood, and Medina (2012) suggested that for daily data on math probes to be useful for instructional decisions, teachers need benchmarks to determine when to continue, modify, or discontinue instruction. The researchers investigated the effects of a crossover discontinue decision rule (i.e., when the number of correct responses exceeds the number of errors for two consecutive days) in terms of impact on student skill attainment, maintenance, and generalization. The study included 8 first and second grade students with math disabilities, including two students with emotional and behavioral disorders and six students with SLD. Special education teachers provided one-on-one instruction during the study after receiving training during three 1-hour training sessions. Student achievement was measured using an abstract level pretest/posttest containing 24 subtraction items, daily 1-minute abstract-level probes containing 60 subtraction items, and a listen/write word problem test with 5-items used to assess generalization. The unit consisted of nine scripted lessons – three concrete stage lessons during which students used manipulatives; three representational stage lessons during which students used worksheets with illustrations of manipultatives; and three abstract stage lessons during which students solved problems with arithmetic symbols. Each lesson consisted of review of previous skills, modeling of the current skills, guided practice including corrective feedback, and independent practice. At the end of each lesson, students took a 10-item mastery test, requiring 90% accuracy to move on to the next lesson. Results of the study demonstrated that all students met mastery of the targeted subtraction skills. In addition, none of the students required all nine lessons in order to meet mastery, with no students completing the third representation level lesson or any of the three abstract level lessons. Researchers found that by monitoring student progress and using the data formatively to adjust instruction, teachers were able to refocus instruction on targeted skill areas of need and determine when students' skills had been remediated. The results demonstrated that using research-based instructional strategies in combination with monitoring student progress, and using the data to make instructional decisions allowed teachers to individualize instruction. Researchers suggested that teachers' responsiveness to student performance data (a) prevented teachers from spending instructional time on unneeded lessons, (b) kept students engaged, and (c) promoted students' maintenance of mastered skills (Sealander, Johnson, Lockwood, & Medina, 2012).

In the literature surrounding DDDM and data use practices across various contexts, widely available data-use guidance has been published by the Institute of Education Sciences (IES; Hamilton, Halverston, Jackson, Mandinach, Supovitz, & Wayman, 2009) Hamilton, Halverston, Jackson, Mandinach, Supovitz, and Wayman (2009) generally referenced "studies of data use practices" as having investigated a combined effect of data use training, data interpretation, and employing software for analysis and storage of data. These experts determined that such studies have not provided conclusive evidence of particular elements within the inquiry cycle that improve achievement. However, five recommendations were offered in the practice guide for using data to support instructional decisions, although they were backed with low levels of evidence: (a) use data as part of an ongoing cycle of instructional improvement, (b) teach students to examine their own data and set goals, (c) establish a clear vision for school-wide data use, (d) provide supports that foster a data-driven culture in the school, and (e) develop a district-wide data system (Hamilton et al., 2009). Specifically for teachers, general suggestions were provided of what a data cycle might involve, such as collecting and preparing a variety of data, interpreting and developing hypotheses about student learning and how to improve it, and modifying instruction to test hypotheses and increase student learning (Hamilton et al., 2009). Again however, low levels of evidence had been located by the panel to support these ideas and provide further guidance for teachers' evidence-based practice.

Fuchs and Vaughn (2012) asserted that since RTI's emergence in 2003, many issues persist in terms of best practice within RTI models, including (a) model implementation, (b) effective data use, (c) decision-making practices and procedures, and (d) differentiating between classroom instruction and validated interventions in the general education setting. In fact, much of the past decade's research on RTI, particularly general education research involving assessment, has focused on frequency of screening and benchmarking.

Of the few studies conducted in the general education setting within an RTI context, measurement that occurs less frequently at regular intervals (e.g. during benchmarks only) has resulted in gains in student achievement that have not led to end of year proficiency. Ball and Gettinger (2009) conducted a year-long study to investigate teacher use of periodic benchmark CBM data to inform reading instruction. In addition, the study focused on the provision of consultative teacher support and feedback on student performance. The study included 8 kindergarten teachers and 103 students across four elementary schools, two private and two public schools. Dynamic Indicators of Basic Early Literacy Skills (DIBELS) benchmarks were administered by research staff (fall, winter, and spring) to monitor progress in reading with four 1-minute measures: letter naming fluency (LNF), initial sound fluency (ISF), phoneme segmenting fluency (PSF), and nonsense word fluency (NWF). Classroom observations were also conducted twice during the year to record information about the instructional environment and activities. A teacher survey was included at the end of the study for teacher perspectives. One week after the fall assessment benchmark, teachers in the CBM with feedback group had a consultative feedback meeting with research staff. During this meeting teachers were provided (a) an explanation of the DIBELS tests, including what each test is designed to measure and how benchmark scores were established; (b) individual student performance results, and (c) a description of both student performance and risk levels. With the exception of assessment explanations, meetings after winter and spring benchmarks were provided in the same manner. However none of the feedback meetings included guidance for instructional changes, only feedback on student performance.

Results of the study indicated that while improvements in student performance were better for the CBM with feedback group, only 51% of students in either group met the end of year reading benchmark. These findings suggest that monitoring student progress only during benchmark intervals, while sufficient for some students and generally informative, provides little evidence that learning outcomes can be attributed to instructional changes. In addition, for students having difficulties learning, monitoring student performance infrequently may not provide teachers with the opportunity and/or information specific enough to adjust instruction in meaningful ways to improve learning towards desired proficiency. Ball and Gettinger (2009) also found that performance feedback was of little value to teachers for meeting students' learning needs, particularly when teachers may not know how to use the information or have the resources necessary to adjust instruction accordingly. These findings suggest that (a) support and feedback for general education teachers needs to be ongoing, (b) support for using data formatively including instructional recommendations may be necessary, and (c) teachers need feedback beyond performance indicators alone. The findings in this general education research also suggest a need for more frequent measurement and evaluation, and report findings similar to those reported by special education researchers in both special and general education settings (Fuchs et al., 1992; Fuchs et al., 1990).

Measurement and review of student performance that occurs frequently for making instructional changes has consistently been shown in the special education literature to improve student achievement and overall proficiency toward end of year criteria. Unfortunately, most studies have investigated multiple aspects of DBIDM simultaneously; therefore, some experts argue that evidence for data-use practice is unclear for each step in the process resulting in improved student outcomes. Similar concerns exist within the literature on RTI. With little focus and information provided in the literature specific to teachers' DBIDM practices as part of ongoing progress monitoring within RTI/MTSS, there tends to be a lack of evidence not only for effective DBIDM practices, but also the impact on student learning.

Teacher Knowledge and Use of DBIDM

Ball and Cohen (1999) suggested that scientific inquiry is essential to teachers' DBIDM within the classroom. RTI/MTSS models structure this type of inquiry through a systematic process of measurement and evaluation, across general and special education settings and all tiers of instruction and supports. Fuchs and Fuchs (2006) described this process as fixed treatment trials for intervention during which evidence-based interventions are implemented and student progress is monitored (Fuchs & Fuchs, 2006a). Therefore, RTI/MTSS offers teachers the opportunity to practice DBIDM, including (a) measuring student academic behaviors during each instructional change, (b) quantifying the instructional effect on student performance, and (c) making accurate judgments about the relationship between instruction and achievement. However, there has been very little primary focus on teachers' DBIDM practices in the research literature, beyond earlier studies that developed an evidence base for DBIDM practices.

Teacher Data Use. Much of what can be found in the special education literature on typical data use practices by teachers includes brief mentions of teachers included in the control groups within earlier DBPM and formative evaluation research. In these studies, typical practice was described as the use of teacher-made tests, unit tests from adopted textbooks, observations of performance, assignments such as workbook and worksheet exercises, and homework, for measurement and evaluation that occurs most often at the end of instruction (Deno & Mirkin, 1977; Fuchs et al., 1984; Fuchs et al., 1989a, 1990).

Fuchs et al. (1991) measured typical procedures for progress monitoring on a post-treatment questionnaire, in which teachers in two experimental groups using CBM and a control group using typical practice reported their reliance on different types of assessments for making instructional decisions. By assigning points totaling 100, teachers reported their use of each of the following: standardized achievement tests, criterion-referenced tests, teacher made tests, daily work grades, unsystematic observation of performance, and systematic monitoring. Control group teachers using typical practice reported relying most on daily work grades (Mean = 30.6), and least on systematic monitoring (Mean = 3.1). Teachers in the experimental CBM group with expert system advice reported relying most on teacher made tests (Mean = 32), while teachers in the CBM group without expert system advice reported relying most on systematic monitoring (Mean = 31.5). Both CBM groups reported relying least on standardized achievement tests (Mean = 4.5, 6.5).

In the same year, a survey of special education teachers across three school districts in two separate states, revealed that the majority of teachers believed collecting objective data frequently was important with 34% marking very important, 37% marking important, and 25% marking somewhat important (Cooke, Heward, Test, Spooner, & Courson, 1991). Despite these beliefs, however, the majority of teachers reported use of techniques or measures that are subjective, insensitive to growth, informal, and unsystematic. When asked about the types of data collected for formative evaluation, teachers reported daily use of in-class written assignments (56%), oral responses (76%), direct observation (78%) and homework (24%) to monitor progress. Most teachers (71%) reported using accuracy data to monitor progress for all or most IEP goals, while 30% used checklists of skills, and 25% used anecdotal notes or letter grades. Teachers reported using interval recording, duration recording, or frequency measures least often with greater than 65% indicating few or none for the number of IEP goals monitored in this manner. Only one-third reported the use of graphs for organizing, displaying, and interpreting data, which was not surprising given the types of data collected most often. Additionally, when asked about reasons behind their use of various data types, teachers most often reported time as the barrier.

Although a similar survey of general education teachers could not be located in the literature, a report of survey, focus group, and interview studies conducted over a 3-year period across multiple states briefly addressed the types of data and their uses reported by general education teachers (Marsh et al., 2006). The report revealed that, like special education teachers, 60% of teachers favored unsystematic progress measures over local benchmark and state assessment data (Marsh et al., 2006). Teachers reported that classroom tests, assignments, and homework aligned more closely with daily instruction and were therefore more useful for their instructional planning. However, for general education teachers, there was no mention of the data organization (i.e., graphing) or data evaluation for making instructional adjustments based on the results of these measures. In addition, general education teachers' use of state and local assessment data at the classroom level was reported as using state assessment data from the previous year to initially revise lesson plans and generally design instruction, and using local assessment results to make class-wide adjustments, (e.g. dividing students into small groups and differentiating instruction). Not surprisingly, using this data to individualize instruction was reported least often, as these measures may not be specific or timely enough to be useful for individual decision-making in the way that frequent systematic progress measures can be.

Kerr, Marsh, Ikemoto, Danilek, and Barney (2006) also examined strategies used in three urban school districts for using data to improve instruction and the effects these actions had on the practice of administrators, principals, and teachers. The mixed-methods study included district site visits during which 85 interviews were conducted, and 72 school visits that included 118 teacher focus groups, and 73 principal, 30 assistant principal, and 50 instructional specialist interviews. The study did not, however, distinguish between teachers in general education and special education settings in describing study participants or results. Although teachers' DBIDM practices were not a primary focus, the findings did reveal the types of data available to teachers, including results of student performance on state tests and district assessments, and results of systematic review(s) of student work samples. Across the three districts included in the study, the majority of teachers reported that systematic reviews of student work were moderately to very useful in guiding instruction; 60% reported results from state tests organized by subtopic or skill as useful; 58% reported performance on district assessments as useful; and 56% reported state performance results organized by student groups as useful. However, details were not provided on how these available data were used and for what instructional purpose. In terms of assessments linked to data use, study findings revealed that while all three of the district included in the study administered formative assessments regularly, only one of the three districts used a set of standards-aligned assessment measures administered across all grades and content areas. More than half of the teachers (59%) from this district reported that the data from these assessments were useful for making classroom level instructional decisions. Teachers reported performing item analyses to group students' needs by objective and determine topics to reteach, although no specific details were provided on this analysis and interpretation process, nor how the data were reported for these results (e.g., class-wide or individual raw scores, percentages, graphs). Similarly in this study, 60% of teachers reported other unsystematic classroom-based assessments were more useful for instructional planning than district assessments. Teachers reported that the results of classroom assessments were timelier and that they were concerned district testing took too much time away from their instruction (Kerr, Marsh, Ikemoto, Danilek, & Barney, 2006).

Despite the fact that teachers' DBIDM practices have not been a primary focus in much of the research, from the limited information that could be located indirectly in the literature, teachers in both general and special education settings continue to opt for informal unsystematic rather than formal objective measures of student performance

(Cooke et al., 1991; Kerr et al., 2006; Fuchs et al., 1984; Fuchs et al., 1989a, 1989b, 1990, 1991; Marsh et al., 2006). The majority of teachers in both general and special education have reported that although various types of data are available, classroom tests and assignments are used most frequently to measure student performance and progress to guide instructional planning. The majority of both general and special education teachers also reported that time is a major factor contributing to not using other assessment types. In addition, only one-third of special education teachers reported graphing assessment results during evaluation or analysis of student data, and no general education teachers reported doing so. No information was provided specific to systematic formative evaluation despite the research-based evidence in the literature and guidance on RTI implementation that suggests such DBIDM practices are both beneficial and essential to teachers in both general and special education.

Data-Use Factors and Barriers. Teachers' DBIDM practices have not been included as a primary focus in research literature, only described indirectly. Therefore, major barriers to data collection and evaluation procedures, including CBM, are reported largely by special education teachers and administrators in the literature. Yell, Deno, and Marston (1992) conducted two studies to determine perceived barriers to effective CBM implementation in special education programs. Study 1 included 49 special education administrators from across the nation. A Delphi Probe was used to survey perceptions in three rounds including exploration, summarization, and consensus. Initially special education administrators were asked to provide a list of 5-10 perceived barriers. In the second phase, these reported barriers were summarized into a list of 100 barriers and sent back to participants to rank using a scale of 1 to 5, with 5 being "very significant" and 1 being “not significant.” In the third phase, the resulting 15 barriers with the highest ranked significance were sent to study participants who were asked to rank the 5 most challenging barriers. In Study 2, special education administrators who participated in the first study submitted names of teacher participants. Of the 356 names submitted, 146 teachers were randomly selected for participation. The procedures in this study followed the Delphi probe procedures used in the first study, however, teachers were asked to answer 10 additional survey questions related to their beliefs regarding the use of CBM. These questions included perceptions of CBM reflecting growth in specific content areas, the use CBM for screening and monitoring progress, and general feelings toward CBM use.

Researchers found that both special education administrators and teachers viewed CBM as valuable, and reported barriers such as time, logistics, and resistance to change. Specifically, administrators reported that teachers do not use CBM data because they may be collecting or charting results without noticing when changes are necessary, or, if teachers are seeing that changes are needed, they may lack knowledge of instructional strategies for making adjustments to current practice. Special education teachers reported that CBM procedures for assessment take time away from instruction. Many teachers questioned the validity of CBM measures in addition to being resistant to changing their traditional methods of monitoring student progress.

Whereas special education practitioners report they may be resistant to change, Jacobs, Gregory, Hoppey, and Yendol-Hoppey (2009) suggested that factors beyond willingness might shape both general and special education teachers’ attitudes towards change in professional practices, including sound DBIDM. In their qualitative study, Jacobs et al. (2009) aimed to develop an understanding of how current teachers are using assessment data to guide instructional decision-making. The study included nine teachers across four elementary schools, all of which were schools that had been part of a school-university partnership. Of the teachers, seven taught general education, one taught special education, and one taught speech/language. Individual interviews were conducted with each teacher using a semi-structured protocol allowing teachers to provide descriptions of their data use and how it informs their instruction. Jacobs et al. (2009) found that there are increasingly complex stages that teachers may experience as they approach data-use practice, including (a) ongoing attention to multiple data sources, (b) a focus on student needs, (c) a developing sense of urgency, and (d) change in professional practice. The researchers suggested that each stage is influenced by teachers' professional knowledge about data, and a culture of support for data use in the schools' context.

Overall, factors and barriers related to general data-use practices have been identified in the literature by both general and special educators, administrators, and superintendents. These include (a) accessibility and timeliness of data, (b) knowledge and understanding of data/capacity for use, (c) training for teachers in data use and analysis, (d) actual and perceived quality of data, and (e) time (Cooke et al., 1991; Kerr et al., 2006; Mandinach et al., 2006; Marsh et al., 2006; Yell, Deno, & Marston, 1992). Kerr et al. (2006) and Marsh et al. (2006) also suggested that additional factors and barriers to district-wide data use practices may be related to more overarching concerns in the general education context including (a) curriculum pacing pressures, (b) motivation for the use of data, (c) organizational culture and leadership, (d) history of state accountability, and (e) alignment of strategies for data use with other initiatives. These factors and barriers were found to be common across three school districts, and educational stakeholders including teachers, principals, assistant principals, and instructional specialists (Kerr et al., 2006; Marsh et al., 2006).

Although student achievement and progress is being measured in multiple ways, and data are more readily available than ever, it has been suggested that practitioners may not be making use of the available data for instructional planning (Fuchs et al., 1989b). In fact, Mandinach et al. (2006) asserted that it is rare to find teachers who regularly engage in thinking critically about the relationship between their instructional practices and student outcomes. All of the barriers and factors described in relation to data-use practices, while separate in the general and special education literature, permeate the continuum of supports and services within RTI that were designed to improve learning outcomes. Therefore, each must be recognized and addressed across both general and special education settings.

Data-Use Supports. Descriptions of support provided for teachers' DBIDM have been included throughout DBPM, CBM, and formative evaluation related studies in both general and special education settings. Fuchs et al. (1991) investigated the provision of support finding that teachers needed ongoing technical assistance to ensure fidelity of measurement and evaluation, including both CBM implementation and being faithful to data decision rules. Special education teachers included in these studies demonstrated fidelity with CBM when this level of support was provided. However, similar staffing resources may or not be possible in a typical school setting.

Ball and Gettinger (2009) and Fuchs et al. (1992) made similar suggestions, finding that general education teachers needed ongoing supports and feedback. Even when collecting and understanding student performance data, researchers found that general education teachers might lack the ability to use the data formatively without instructional recommendations. The literature suggests that some schools, in fact, are increasingly staffing instructional specialists and coaches who provide such supports for teachers, for example, those taking part in state and district-wide school improvement initiatives. Roehrig Duggar, Moats, Glover, and Mincey (2008) conducted a qualitative study primarily focused on the effects of coaching, as part of a Reading First initiative, on general education teachers' use of progress monitoring data to inform literacy instruction.

The study included 10 teachers in kindergarten and first-grade and four reading coaches across four schools in one Florida school district (Roehrig Duggar, Moats, Glover, & Mincey, 2008). In the study, coaches administered benchmark progress monitoring assessments using Dynamic Indicators of Basic Early Literacy Skills (DIBELS) four times a year. Although coaches administered assessments, the data were made readily available to general education teachers online. The only information provided regarding teachers' DBIDM practices was that teachers reported generally interacting with data in order to (a) monitor student strengths and needs, (b) organize flexible groups, and (c) identify appropriate instruction in terms of activities, intensity, and level. One teacher was quoted describing that despite the availability of a coach and progress monitoring data, they were unsure of what to do and how to help their struggling learners. In addition, despite the support that coaches attempted to provide, a lack of time (including the availability of the coach) and classroom management difficulties were reported as barriers to teachers' use of data to inform instruction.

With appropriate supports within the RTI context (e.g., consultative coaching in conjunction with initial teacher training and training follow-up), general education teachers were found to implement effective individualized interventions in the general education classroom. Vernon-Feagans, Kainz, Amendum, Ginsberg, and Wood (2012) conducted a study on the effectiveness of a Tier 2 reading intervention provided by general education teachers with consultative coaching support from a literacy specialist on a bi-weekly basis. The study was conducted across 5 Title 1 schools (two experimental and three control schools), including 18 kindergarten and 16 first grade teachers, along with 132 kindergarten students, and 144 first grade students. The Targeted Reading Intervention (TRI) allowed teachers to provide individualized instruction to students in a one-on-one instructional grouping, 15 minutes a day, 4 times each week. Training was provided through a 3-day summer workshop; consultation occurred weekly then later bi-weekly; bi-weekly grade level meetings were held with the literacy coach; and bi-monthly workshops were conducted based on teacher needs throughout the year. Results of the study demonstrated gains by students in the experimental group that doubled the gains of students in the control group. These findings support that, with consultative support, general education teachers can effectively help struggling readers by providing individualized interventions in the classroom setting. Researchers assert that with this level of support, including initial training; bi-weekly consultation and grade-level meetings and bi-weekly training workshops, general education teachers can be just as effective as outside tutors in providing effective Tier 2 interventions (Vernon-Feagans, Kainz, Amendum, Ginsberg, & Wood; 2012). Here again, however, there were no details provided specific to general education teachers' DBIDM practices during this standard treatment protocol intervention.

Suggestions for Improved DBIDM. Supports for teachers' DBIDM, provided both during research studies and reported in investigations of district-wide data use, have varied. Some studies have described training provided through one-shot workshops by district or school level support staff, online, and through external partnerships such as educational agencies or institutions of higher education as minimally effective (Marsh et al., 2006). Other studies have described training that was periodic and consultative in nature, focusing only on aggregated benchmark results rather than a connection with instructional planning, as somewhat beneficial (Ball & Gettinger, 2009). Without instructional recommendations, however, teachers may not know how to use data effectively to adjust instruction in ways to reach struggling learners. For example, when data are collected by researchers or coaches and instruction is carried out by the teacher, there can be disconnects in the measurement and evaluation process (Roehrig et al., 2008). Receiving only performance indicator results, and not assessing students themselves may leave teachers without specific student response information necessary for skills analysis. In turn, teachers may be unsure of how to connect assessment and instruction. Similar types of supports in other studies have shown change for only a portion of students and teachers (e.g., instructional adjustment for only 58% of students made by 57% of teachers; Fuchs et al., 1989b).

Because teachers' ability and preparedness for DBIDM varies by experience and knowledge, to effect more widespread change in practice, training and support may need to be tailored to meet teachers at their current level of development (Jacobs et al., 2009).

Jacobs et al. (2009) suggested providing professional development for in-service teachers as well as training for pre-service teachers in collaboration with universities and district/school-based support staff. Such trainings in data collection and evaluation should be centered around an understanding of both the purpose and procedures of CBM implementation including (a) the need for collecting data on the frequency of academic behaviors that is objective and sensitive to change, (b) the validity and utility of such data, (c) graphing student performance, (d) measuring progress, and (e) evaluating instructional effects using data decision rules to guide necessary changes (Cooke et al., 1991; Yell et al., 1992). Yell et al. (1992), Fuchs et al. (1992), and L.S. Fuchs et al. (1991) suggested providing ongoing supports to teachers following training through various formats including consultation, mentoring, peer coaching, and collaboration with colleagues regarding DBIDM practices, particularly in relation to fidelity of implementation and instructional adjustments. These suggestions mirror the supports found effective, by Vernon-Feagans et al. (2012), with general education teachers providing interventions within the RTI context.

In summary, in addition to evidence to support the benefit of teachers' frequent measurement of student performance and formative use of that data, the literature also suggests the need for teacher knowledge, training, and support in connecting assessments of student learning to effective instruction using DBIDM. All teachers—those making individual decisions in special education, and both class-wide and individual decisions in general education—have collectively been found to benefit from measurement feedback that includes not only proficiency indicators but also skills analysis to better develop descriptions of students' learning needs, instructional recommendations for making necessary adjustments and using data for instructional purposes (Ball & Gettinger, 2009; Fuchs et al., 1992; Fuchs et al., 1991), and initial and ongoing training along with consultative support for providing effective interventions within Tier 2 of RTI (Vernon-Feagans et al., 2012). These types of school-based supports can be used to help facilitate frequent teacher collaboration regarding student data and instruction. Additionally, these types of supports can establish a school-wide culture of support for general education teachers' DBIDM practices from school leaders, curriculum specialists and special education teachers (Jacobs et al., 2009; Vernon-Feagans et al., 2012).

Summary

Teachers are responsible for instructional practices and decisions in the classroom that have the potential to affect positive change in student achievement, both within and beyond RTI and similar MTSS models. Therefore, teachers' DBIDM practices should include systematic measurement and evaluation to create an ongoing cycle of collecting, analyzing, and responding to assessment data. By collecting student performance data from instructionally relevant assessment measures, teachers are able to use the resulting data to formatively guide instruction. These DBIDM practices are fundamental to ensuring that teachers effectively connect assessment to instruction that is individualized and tailored responsively to meet students' diverse learning needs. Teachers' provision of instruction that meets the needs of various learners in the classroom, those with and without disabilities, can produce both meaningful learning opportunities and improved learning outcomes, as emphasized in NCLB and IDEIA.

Researchers' findings in earlier special education literature provide research-based evidence to support that the protocol and procedures of CBM for formative evaluation creates a cycle of standardized procedures for measurement and evaluation. Although not directly connected in the research or practice literature, the renewed focus on DBIDM practices within large-scale district and school-wide initiatives such as RTI/MTSS highlight the critical need for a protocol including standardized procedures to guide teachers in connecting assessment and instruction. In order to use data as the basis for making appropriate instructional decisions within RTI, general education teachers must know the protocol for addressing students' academic learning needs at all levels of the school-wide prevention-intervention model. Particularly, it is important for teachers providing Tier 2 interventions in a RTI model to understand the procedures of measurement and evaluation of student performance. Tier 2 is said to be a "critical juncture" at which this level of support can improve student performance for a return to general education, or determine the need for a referral to special education (Compton, Fuchs, & Fuchs, 2006). General education teachers' DBIDM practices at each tier within RTI, should therefore include objective measurement of student performance, using CBM, for screening and formative benchmarking of all students, and frequent progress monitoring of students identified as at-risk. Practices should also include charting and graphing results of student progress measurements, applying standardized data decision rules during regular review, and intensifying SRBI that is increasingly targeted and explicit (Fuchs & Fuchs, 2006; Johnson et al. 2006; Fuchs & Fuchs, 2006).

Researchers' findings in the literature support that despite the evidence for these procedures as the foundation of DBIDM practice in the classroom, teacher practices vary greatly. Variations have been described both in terms of teachers' measurement of student progress, and formative use of instructionally relevant data including the types and frequency of assessment, and how the results are used during evaluation to inform instruction. Indirect descriptions of teachers' data use found in the literature suggest that DBIDM may not be prevalent practice amongst general and special education teachers, particularly when it comes to using available assessment data to guide instruction. Researchers, however, have not focused directly on teachers' DBIDM practices in relation to frequent progress monitoring expected within RTI. To date, there have been no studies to specifically investigate general education teachers' DBIDM at the classroom level, particularly in relation to essential practice within RTI.

Researchers have suggested in the literature that teachers' DBIDM practices reflect their knowledge, experience, and support in regards to frequent measurement and evaluation using technically sound assessment measures. Suggestions have been made throughout decades of literature both in terms of what better teacher training might include, and how training can be paired with ongoing supports to provide technical assistance for teachers' DBIDM. The emphasis in more recent literature is on the need for building a culture of support for data use school-wide to address factors and barriers related to data use. To date no studies have investigated factors, barriers, and supports to teachers' DBIDM in relation to systematic processes within RTI.

Because there appears to be a gap in the research literature, specific to teachers' DBIDM within tiered academic interventions, this may indicate a gap between research and practice in which DBIDM is not a seamless part of teachers' professional practice and daily routine in the classroom. In order to address these gaps in future efforts and research, it is essential to first gain an understanding of current practice. Therefore, this study investigated teachers' DBIDM, including their collection, analysis, and response to data at the classroom level within Tiers 1 and 2 of RTI. This study also investigated teacher perceptions related to their DBIDM practices including factors, barriers, supports, and the impact on student outcomes. In addition, this study also examined the relationship between teachers' DBIDM practices and perceptions. The information gained through this study contributes to an area in the literature that has received little focused attention, yet need for further research and development has been suggested. The findings of this study have implications for future efforts and research to scale-up widespread use and sustained practice of DBIDM, particularly within RTI models.

CHAPTER 3

Research Methodology

The purposes of this research study were to investigate data-based instructional decision-making (DBIDM) practices of general education teachers implementing a Response to Intervention (RTI) model to address students' academic needs in elementary schools, and to determine the relationship between general education teachers' reported DBIDM practices and their perceptions of related data-use factors. Specifically, this study examined aspects of classroom teachers' formative data use within tiered academic interventions to describe (a) how teachers report using data from assessments of student performance and progress, to plan effective tiered academic instruction and interventions; (b) teachers' perceptions of DBIDM practices in relation to their experience, knowledge, training, support, and the effect on student learning outcomes; and (c) how teachers' reported perceptions of data-use factors influence their reported DBIDM practices at Tier 1. The main research questions this study answered were:

1. How do teachers report using data formatively to make classroom-level instructional decisions for students at Tiers 1 and 2 of their school's Response to Intervention (RTI) model?
2. What are teachers' perceptions of the impact their DBIDM practices have on student learning?

3. What are teachers' perceptions of the importance of and their preparation for progress monitoring as part of DBIDM?

4. What are teachers' perceptions of factors, barriers, and school-based supports for their use of DBIDM practices?

5. What is the relationship between teachers' reported DBIDM practices within Tier 1 of RTI, and their perceptions of the impact of these practices on student learning, importance of and preparedness for progress monitoring, and school-based supports?

The information obtained to answer the research questions in this study is useful locally for teacher reflection on data use practices; efforts that encourage DBIDM at the classroom level, particularly as schools, districts, and the state plan and implement ongoing professional development and technical assistance; and teacher education programs, as they prepare future teachers with the knowledge and skills necessary for formative data use. In addition, this information is useful on a larger scale for informing future research and related efforts to make DBIDM practices a seamless part of planning daily instruction that meets students' diverse academic needs and supports progress towards and achievement of grade level state standards.

The purpose of this chapter is to provide an overview of the methodology implemented in this study. The overview begins with the study design, which includes a description of the procedures for defining and restricting the sample frame, the study setting and participants. The overview then includes a description of the instrumentation, procedures for data collection, data analysis, and considerations for reliability and validity.

Methods

Study Design

This quantitative study was designed to investigate DBIDM practices of general education teachers within tiered academic interventions by measuring teacher reports of their formative data use, and perceptions related to these practices. Survey methods were used to examine aspects of K-3 general education classroom teachers' formative data use within tiered academic interventions. The initial study population included four of 81 school districts in the state of South Carolina (5%); 35 primary and elementary schools (33% of all primary and elementary schools established and in operation prior to and following August 2014 across the four districts); and 620 general education teachers in grades K-3 (100% of K-3 general education teachers in 35 schools within the four districts).

Population. The target population for this survey study was K-3 general education teachers in primary and elementary schools implementing a RTI model to address students' academic needs, in the state of South Carolina. Because a list of individuals in this population was not readily available, multiple stages were used to define the sample frame by creating a list of districts, schools, and teachers from which individual teachers could be sampled within the population (Dillman, Smyth, & Christian, 2014).

Stage 1 of defining the sample frame. The first stage of defining the sample frame, to determine which districts/schools in South Carolina are implementing RTI, included two major steps: identifying districts/schools potentially implementing RTI and confirming RTI implementation in the district/schools. First, a search on the South

Carolina Department of Education (SCDE) website was conducted, followed by emails to SCDE staff within the Office of Special Education Services and Office of School Transformation. The SCDE website search resulted in eight potential districts, with one school per district identified. Emails to SCDE staff resulted in 12 potential districts, five of which had been identified via the SCDE website search. Using SCDE website and personnel guidance, 15 districts were identified statewide as potentially implementing RTI in one, some, or all primary and elementary schools in the district. Unfortunately, there was no certainty of the current status of RTI implementation in these districts.

In order to confirm that RTI is being implemented within these districts and determine which schools within the 15 districts are implementing RTI school-wide, each district's website was searched for related terms, e.g. RTI, Multi-tiered Systems of Support (MTSS), early intervention services/supports, instructional/academic support services, special education/exceptional children. RTI implementation within these districts could not be confirmed in this manner. Therefore, the district websites were used to identify a contact from each district in the Accountability, Exceptional Children/Special Education, and/or Curriculum and Instruction department. Twenty-two identified contacts, 1-2 per district, were emailed a brief overview of the study, requesting the following information: a) if schools within the district implement a RTI model for addressing students' academic needs; b) which schools in the district do so, and c) if this is an expectation district-wide (i.e. all primary and elementary schools implement RTI for academics). In addition, the district websites were used to identify information specific to the process for proposing to conduct research within the district. If this information was not located, it was also requested in the email to district contacts.

RTI implementation was confirmed by five districts, each reporting that RTI is being implemented district-wide, across all primary and elementary schools. Initial responses were received from three other districts, promising to send further information, although this was not provided despite follow-up emails sent; another district's contact replied that this was not their area, although no direction for a contact in the district was provided despite requests; and one district's contact replied that their district could not accommodate this study. No responses, to initial and follow-up emails, were received from contacts in the remaining five districts.

Stage 2 of defining the sample frame. To identify elementary schools in each of the five districts implementing RTI district-wide, the school directory on the SCDE website was used to create a list of primary and elementary schools by district. This list included all primary and elementary schools (including magnet and charter schools) within each district. The list was then crosschecked using each districts' website to ensure that the SCDE school listings were up to date with each district's list of primary and elementary schools. During this check, two schools within one district were removed from the list, as each school was no longer in operation. After a final check, using the 2014 Primary and Elementary Performance Data spreadsheet located on the SCDE website, one school was removed from two of the districts because the two schools had only recently been established, opening in the upcoming school year. The finalized list of schools included a total of 116 primary and elementary schools that had been established prior to and were still operating beyond August 2014. Also during this stage of sampling, additional district/school profile information was recorded for each school and compiled on a spreadsheet, in the event the information was useful during analysis for making any within and between group comparisons. The 2014 District and School Report Cards as well as a 2014 Title One School List by district (all obtained from the SCDE website) were used to identify the following for each district and school: grade levels; student enrollment; students with disabilities (%); total number of teachers in the school; and professional development days per teacher.

Stage 3 of defining the sample frame. The final stage of defining the sample frame was to identify general education teachers within each of the 116 primary and elementary schools implementing RTI. The website for each school was searched to determine the number of general education teachers within each grade level. As each website was searched using the staff directory, the number of teachers from each grade level was counted and recorded on a spreadsheet. When available, the teacher emails were also obtained from the website for later use during survey distribution. Once each schools' website had been searched and teacher numbers recorded, the total number of general education teachers in each grade level was calculated first by school, then by district, using spreadsheet formulas to avoid any calculation errors. Total numbers of general education teachers (K-3) were calculated by school, then by district, in the same manner. The total numbers of general education teachers across all grade levels from each district were then added, using spreadsheet formulas, to determine an approximate total of 2,645 general education teachers across the five districts within the 116 primary and elementary schools. The same calculations were performed for total numbers of K-3 teachers within each district, using spreadsheet formulas, to determine the approximate sample size for this study: 1,858 general education teachers (K-3). This proposed sample represented 100% of K-3 teachers in the 116 primary and elementary schools within the five identified districts, which was also representative of 70% of all general education teachers in the identified schools and districts. The proposed sample of teachers was approximate, as it depended upon the accuracy of the website listings, as well as district and principal approvals for conducting research within each district and school.

Restricting the sample frame. After obtaining approval for this study from the Institutional Review Board (IRB) at the University of South Carolina, proposals to conduct research with each of the five proposed districts were submitted. Responses were received from each district, with approvals obtained from four school districts. One district declined to participate due to the numerous initiatives within the district that are currently demanding teacher attention, such as Student Learning Objectives (SLOs), new content standards, new testing, 1-to-1 technology, etc. The sample frame was therefore restricted to K-3 general education teachers in 106 primary and elementary schools across the four approved school districts.

In addition, according to approval guidelines and protocols for each of the approved districts, principal approval was also obtained following district approval and prior to contacting teachers. A 2014-15 School-Principal Information spreadsheet (obtained from the SCDE website) was used to identify principal names and emails for each school. A list was created for each district that included the name of each school, the school principal's name and email. Upon approval, an email was sent by the research committee chair in each district to notify principals of the district-approved study. Therefore, an initial email and two reminders were sent to principals for obtaining approval to contact teachers. Each email requested that principals provide a response including whether they do/do not approve of their teachers' potential participation in the study. In addition, if they approved, principals were asked to also provide a list of K-3 general education teachers' names and emails. Principals that preferred to send the emails to teachers themselves were asked to provide the number of K-3 general education teachers in their school to whom the survey emails would be forwarded. These steps were taken to ensure accurate population and sample size calculations, as well as the ability to contact each teacher included in the sample via personalized, individual emails.

Principals in a total of 35 schools provided approval across the four districts. Of these, 28 principals provided a list of names and emails for K-3 general education teachers in their schools; and seven principals provided the number of K-3 general education teachers in their school, as they preferred to forward the email contacts regarding the study to teachers themselves. The sample frame therefore was further restricted to include K-3 teachers in 35 primary and elementary schools within each of the four approved districts, for which principals approved teachers' potential participation in the study.

Study setting. This study was conducted across four school districts within the state of South Carolina. Each of the districts confirmed current implementation of RTI district-wide, in all primary/elementary schools as a school-wide model to address students' academic needs. Table 3.1 displays the characteristics of each participating school district including district-wide student enrollment, geographic location and region within the state, and the type of community the district represents within the state. As shown in Table 3.1, the four participating school districts were representative (a) geographically, representing four different regions across the state; and (b) community type/number of student served, representing two large urban districts serving more than

40,000 students, one moderate suburban district serving more than 24,000 students, and one small rural district serving more than 11,000 students.

Table 3.1

Characteristics of Participating School Districts

District	Student Enrollment	Location (Region)	Community Type
A	45,773	Southeast (Trident)	Urban
B	40,978	Northeast (Waccamaw)	Urban
C	11,972	North (Catawba)	Rural
D	24,222	Central (Midlands)	Suburban

There were a total of 106 potential primary/elementary schools across the four districts, of which principals in 35 schools (33%) approved potential participation of their K-3 general education teachers in the study. Table 3.2 displays the number of potential and participating schools within each district, as well as the number of potential K-3 general education teacher participants in each district.

Study participants. The study population included 620 general education teachers (K-3) in 35 primary and elementary schools across four school districts in South Carolina, as shown in Table 3.2. All K-3 general education teachers in principal approved schools (100%) were included in the sample frame and invited to participate in the survey. This provided all teachers in participating schools and districts the same opportunity to be included in the study sample.

Table 3.2

School Participation and Potential Teacher Participants within Each District

District	Potential Schools n	Participating Schools n (%)	Potential Teacher Participants n
A	51	10 (20%)	130
B	29	8 (28%)	189
C	10	5 (50%)	67
D	16	12 (75%)	234
Total	106	35 (33%)	620

Instrumentation

Survey methods were used to collect information for the purposes of this study (Fink, 2013). Survey items were designed to reflect both historical and current research on teachers' DBIDM practices and RTI in order to answer the five research questions for this study. A chart is provided, as Appendix A, to demonstrate the alignment between study research questions and survey items, including citations from the literature.

Survey pilot. An initial version of the questionnaire, including standardized directions, was developed based on a review of the literature. An advisory panel, including four practitioners with experience in classroom-level DBIDM and RTI, as well as three experts in RTI reviewed this version. Each reviewer was asked to provide feedback on the question items and design of the survey instrument as part of a pilot test (Fowler, 2014). Those involved in the pilot test provided feedback in the following areas:

(a) whether the link to the survey worked properly, (b) if they were able to complete the survey without any technical difficulties, (c) the length of time it took to complete the survey; d) if the survey was too long or to complicated (e) clarity of directions for self-administration, (f) clarity of items and response choices, and (g) any suggested edits for grammar, spelling, and/or question items and response choices (Fowler, 2014). No items were removed or added to the survey instrument, however minor revisions to clarify the survey items were made according to feedback. After the proposal, no additional items were added to or removed from the instrument, although minor formatting revisions were made to the survey based on committee recommendations. The finalized survey instrument is provided as Appendix B.

Survey design. A web-based survey was developed to gain information from elementary level (K-3) general education teachers in South Carolina school districts implementing RTI district-wide. The 30-item questionnaire consisted of Likert-type, close-ended, and open-ended items related to teachers' data collection and use. The use of various question types within the survey instrument allowed for gaining a better understanding of respondents and their current data use practices. Close-ended items included a "Don't Know", "Does Not Apply" or "Other" response choice in order to provide participants the opportunity to select an appropriate response or to supply a response should it not be reflected in response choices. In addition, participants were not required to provide a response for each item, which allowed them to skip items if desired, as well as to back up or advance forward in the survey in efforts to increase motivation and the likelihood of participants completing the survey (Dillman, Smyth, & Christian, 2014). The survey instrument was created in SurveyMonkey™ (1999-2015). Using a web-based instrument allowed participants to provide their responses individually, at a time and location most convenient to them.

The survey began with an introduction page, which provided teachers with a brief overview of the survey purpose and format, including the expected length of time for completion. In addition, teachers were reminded that participation was voluntary and that all survey response would remain confidential. Following the introduction, the survey contained the 30-item questionnaire. Because the survey addressed teacher's data use for both class-wide and individual decision-making at Tiers 1 and 2 within their school's RTI model, these 30 items were organized into three sections. The first questionnaire section included two items specific to the schools' RTI models. This section gathered information about the RTI model in the respondent's school including the approach and standard decision rules that guide school-wide DBIDM practices. This section provided information about teachers' knowledge of their schools' RTI model and procedures, which might have factored in to responses in the remaining survey items. Additionally, the information from this section was used in the analysis of survey responses as school-level factors related to teachers' classroom level DBIDM practices.

The second questionnaire section of the survey included 16 items specific to DBIDM practices at Tier 1, in which both class-wide and individual decision-making with screening and benchmark progress monitoring is characteristic. These items gathered information in relation to practices including measurement (frequency, types of measures, recording and graphing) and evaluation (frequency and use of information). In addition, the items gathered information related to perceived importance of and preparedness for progress monitoring, as well as the impact of and barriers/supports to teachers' data use practices within Tier 1. The information provided in this section was used in the analysis of survey responses for describing (a) teacher-reported DBIDM practices for all students in the general education setting, during core instruction; (b) teacher perceptions of the importance of and preparedness for progress monitoring, impact on student learning outcomes, and factors/barriers/supports; and (c) the impact of these perceptions and data-use factors on teacher's DBIDM practices within Tier 1.

The third questionnaire section included 11 items. The first item in this section asked teachers about the content area in which they provide Tier 2 interventions. Based on the teacher's response, this item was used to direct participants either to continue on to the following questions in the Tier 2 section, or opt out of the section to complete a final open-ended item. This opt out question was necessary between sections because not all general education teachers in the sample may be responsible for providing Tier 2 interventions within their school's RTI model. The remaining items in the Tier 2 section gathered similar information to items in the previous survey section, although the questions and response choices provided were more specific to the individualized decision-making and frequent progress monitoring that is characteristic within Tier 2. This section also gathered information related to the steps included during measurement, evaluation, and response as part of DBIDM, as well as barriers/supports to teacher's data use practices within Tier 2. The information gathered from these items was used in the analysis of survey responses for describing teacher reported data use practices for a smaller group of students in need of more intensive supports in addition to those provided during core instruction. In addition, the responses in this section were used to make comparisons to reported practices, perceptions, impact, barriers and supports in the questionnaire items in the previous section related to Tier 1. One final questionnaire item, following the Tier 2 section, provided participants the opportunity to share additional information related to data collection and use. This item helped to fill any gaps in information perhaps not requested but perceived as important to practitioners responding to the survey.

The final portion of the survey included eight demographic questions to gather information about the respondent's degree level, area and method of certification, current teaching role/position, experience level, grade level assignment, district, and school. Each of these items was close-ended and allowed respondents to select only one answer choice per question. The information from this section was useful in understanding the sample from which data was gathered. In addition, this information was used prior to the analysis of survey responses to ensure analyzed responses were from general education teachers, and teachers in grades K, 1, 2, and 3.

Procedures

Survey methods, based on recommendations in the literature for conducting web-based survey research, were used to gather information for this study (Dillman et al., 2014). District approvals to conduct the study were received at different times, which made two rounds of data collection necessary. Data collection for the study took place over a three-month period during the 2015-2016 school year. In each round, data collection followed a 4-contact strategy in which three contacts were made within the first two weeks (Dillman et al., 2014). In week one of each data collection round and wave, the initial email was sent on Tuesday and the first reminder was sent on Friday. The following week, a second reminder was sent on Wednesday. A final follow-up email was sent on Tuesday of the third week. Each email was sent individually to teachers and/or principals in order to prevent it from going to spam as a bulk email. Additionally, each email was personalized, sent early in the day, and included varied messages and subject lines in order to increase response rates (Dillman et al., 2014). A reminder was also included in each email contact that participation was voluntary and survey responses would remain confidential. In accordance with district guidelines and protocols, the initial email contained a statement informing teachers that the district had approved, but was neither sponsoring nor conducting the survey. A secure link, automatically generated during survey development, was contained within each email contact for immediate access to the web-based survey, on the SurveyMonkey™ (1999-2015) website. Teachers acknowledged their consent to participate by accessing the survey and clicking "Next" at the bottom of the introduction page. The initial and three follow-up contacts are provided as Appendices C, D, E and F.

Table 3.3 displays the districts, dates, and initial population included in each round. As shown in Table 3.3, in the first round of data collection, the survey link was sent via email to 431 teachers in three approved districts (A, C, and D) in three waves, each lasting four weeks. This represented all K-3 general education teachers (100%) in 27 schools across the three districts. In the second data collection round, which also lasted four weeks, a new survey link to an identical survey instrument was sent via email to 189 teachers in District B. This represented all K-3 general education teachers (100%) in eight schools across the district.

Table 3.3

Data Collection Timeline

Round	Dates	Initial Population n	Non-Participants n
1 – Districts A, C, and D	October 20th – November 24th, 2015	431	3
2 – District B	January 5th – January 26th, 2016	189	2
	Total	620	615

Initial email contacts in the first round included 366 individual teacher emails and three principal emails, forwarded by school principals to the remaining 65 teachers; and in the second round included 102 individual teacher emails and four principal emails, forwarded by school principals to the remaining 87 teachers. After this initial contact, 19 contact emails were returned as undeliverable (16 in round 1, 3 in round 2). Each email address was crosschecked with principal provided email lists or on school websites. If neither of these options provided a deliverable address, then the principal was emailed to obtain a deliverable email address. The correspondence was sent to the corrected email for each of these 19 teachers later in the same day. Because responses were collected anonymously in SurveyMonkey™ (1999-2015), initial and reminder emails were sent to each teacher participant listed, unless they emailed to confirm completion of the survey or to decline participation. Forty-one teachers responded to reminder email contacts confirming that they had completed the survey (30 in round 1, 11 in round 2), after which their names were removed from the contact list for remaining follow-up emails. Five teachers emailed to decline participation, stating that they were not interested in participating and asking to be removed from the list (3 in round 1, 2 in round 2). These five teachers were noted as "non-participants", and removed from the initial study population. Additionally, all principals forwarded the initial email to teachers (n = 65) on the same day it was sent in both data collection rounds, which was confirmed by copying me in on the correspondence. However, while this confirmation was requested with each contact, the principal in only one school in the first round confirmed forwarding all four contacts (100%) to the 29 teachers in the school; while the two other principals in round one confirmed sending two of four emails (50%) to the 46 teachers in their schools. In round two, the principal in one school confirmed sending three of four emails (75%) to the 23 teachers in the school; while the other three principals in round two confirmed sending two of four emails (50%) to the 64 teachers in their schools.

Data Analysis

The items included in this survey reflected both historical and more recent research related to teachers' DBIDM practices beyond and within RTI. Quantitative and qualitative analyses were used to analyze the survey responses, in order to answer each research question in this study.

Data Management. Raw data compiled from survey responses in the SurveyMonkey™ (1999-2015) database were exported, in numerical form including text responses, to a Microsoft® Excel for Mac 2011 spreadsheet. The data were formatted to allow SAS® University Edition to open and read the data set for statistical analysis, which included (a) naming each item and/or sub-item variable; (b) cutting and pasting open-ended responses into Sheet 2 of the Excel document; and (c) combining the raw data sets for data collection rounds 1 and 2. Variable names, values, and value descriptions are provided by research question in Appendix G (Tables G.1 through G.5).

Prior to data analysis, the raw data were cleaned to ensure that only response data from K-3 general education teachers who provided answers beyond the initial survey section were included in the analyzed data set. Every effort was made to clarify prior to completing the survey (including during district and school level approval for participation, in both individual and principal emails sent to teachers with the survey link, and in the introduction to the electronic survey) that the intended participants were general education teachers in grades K-3. Additionally, the contact list with teachers' names and emails were confirmed with the principal (or instructional coaches in two schools) at each participating school as including only K-3 general education teachers. The purpose of survey item 34 in the demographics section was a final step to ensure that only responses from general education teachers' were included in the analyzed sample if perhaps those other than general education teachers had received and responded to the survey. Five respondents indicated "Other" for this item. Descriptive responses were reviewed to determine if these could be recoded using an existing response category, or if maintaining the category of "Other" was most appropriate. All five responses were recoded as 1s for general education, including two teachers that noted they were immersion teachers which is considered general education in this school—where students learn content in both English and Spanish—another teacher that noted being the only teacher for the grade level, one that noted being a general education teacher that does interventions, and a final teacher that noted teaching general education, gifted and talented. All response data for two respondents, identified as special education teachers, were removed from the data set prior to analysis.

Just as efforts to clarify, prior to respondents completing the survey, that the intended audience was general education teachers, the same efforts were made to ensure the inclusion of teachers in only grades K-3. The purpose of survey item 36 was a final step to ensure that only responses from general education teachers in grades K, 1, 2, or 3 were included in the analyzed sample if perhaps teachers in grades PK, 4, and 5 – also included in primary and elementary level schools – had received and responded to the survey. Five respondents indicated "Other" for this item. Two respondents were recoded as 5s, creating a new category for a combination of grades within the K-3 range. All response data for three respondents were removed from the data set prior to analysis, including one descriptive response that was unclear ($$$$$), a 4th grade teacher, and a Pre-K teacher.

All raw data were also reviewed to determine if respondents provided an answer to survey questions beyond the first section of the survey. If no responses were provided after item 2 of the survey, all response data were removed prior to analysis. Response data for 56 respondents were removed after this data clean step. Table 3.4 displays the frequency counts and percentages for the study population, completed sample, return rate, and analyzed samples.

Table 3.4

Study Population and Sample

Data Collection Round – District(s)	Study Population n	Completed Sample n	Return Rate	Analyzed Sample [a] n (% cs)	Analyzed Sample [b] n (% cs)
Round 1 –A, C, and D	431	154	36%	112 (73%)	
Round 2 –B	189	70	37%	51 (72%)	
Total	620	224	36%	163 (73%)	152 (68%)

Note. The study population n for each data collection round represents 100% K-3 teachers in all participating schools; % cs = percentage of the completed sample.
[a] = analyzed sample used for research questions 1-4; [b] = analyzed sample used for research question 5.

The completed sample, n = 224, represents an overall return rate of 36% from the 620 teachers invited to participate in the survey across two rounds of data collection. The final response rate, after removing the five "non-participants", remained at 36%.The analyzed sample [a], n = 163, includes the total number of teacher responses after raw data were cleaned to remove responses identified as those from non-general education teachers, general education teachers in grades other than K-3, and participants that did not complete at least one section of the survey to describe their DBIDM practice in either Tier 1 or 2 (i.e., responses not provided beyond the first two items related only to the school's RTI model). Analyzed sample [a] was used in the analysis of research questions 1, 2, 3, and 4. The analyzed sample [b], n = 152, includes the total number of teacher responses after data included in the first analyzed sample were cleaned to remove missing observations from each of the variables included in the logistic regression model. Analyzed sample [b] was used in the analysis of research question 5.

Descriptive statistics were used for analysis of all initial variables resulting from Likert-type and close-ended items, and for variables created from initial variables that were used to fit a logistic regression model to the data. These results are presented using text, tables, and figures within Chapter 4 and Appendix H in relation to each research question. Results are presented as measures of frequency (counts and percentages), central tendency (means) and variation (standard deviations) as appropriate for each item type and variable values (Fink, 2013). Inferential statistics were also used to evaluate model fit of the logistic regression to the data and for analysis of created variables in the logistic regression model. These results are presented using text and tables within Chapter 4 and Appendix H in relation to research question 5. Results are presented as measures of prediction (regression coefficients), dispersion (standard error), sampling distribution (chi-square/likelihood ratios and degrees freedom), effect size (odds ratios), and estimation (confidence intervals) as appropriate for each item type and variable values (Fink, 2013).

Initially there was a plan to conduct qualitative analyses for responses to open-ended items using structural and descriptive coding (Saldana, 2013). However, content analysis was deemed a more appropriate method for making inferences in relation to the information contained in the open-ended responses to this survey (Fink, 2013). A list including each distinct response was created by the copying and pasting open-ended responses from the raw data exported from SurveyMonkey™ into Microsoft® Excel for

Mac 2011 spreadsheet with columns labeled by item number and topic (e.g., types of formative assessments used, factors, barriers, supports, specific responses provided as “other”, etc.). All responses were carefully read multiple times. Then identical and similar words and phrases from teachers’ descriptive responses were grouped in order to count the frequency of teachers providing that response, i.e., quantify them (Fink, 2013). Grouped descriptive words and phrases were then organized by concepts or themes to create overarching categories and subcategories to describe practices and perceptions within each open-ended response item. The results are presented using text and tables within Chapter 4, with detailed responses directly from participants included in Appendix H, in relation to research questions 1 through 4.

Research question #1. How do teachers report using data formatively to make classroom-level instructional decisions for students at Tiers 1 and 2 of their school's Response to Intervention (RTI) model?

There were 13 survey items related to the first research question, describing how teachers report using data formatively to make classroom-level instructional decisions for students at Tiers 1 and 2 of their school’s RTI model. A summary of the variables, values, and value descriptions related to this research question are provided as Appendix G (Table G.1). Analyzed variables resulted from twelve close-ended items including two 4-point Likert-scale items, seven close-ended checklist items (i.e., mark all that apply), and three scaled items related to frequency (two with 8 choices, the other with 5) from the Tier 1 and Tier 2 sections of the survey. Descriptive statistics are reported for the frequency of use for three major data sources/assessment types at Tier 1 and 2; frequency of use of common progress monitoring measures; typical methods of recording assessment results; frequency of and barriers to graphing; frequency of evaluation and data review, both individually and collaboratively; how these major sources/data are used in general at Tier 1 and 2; and specific practices within measurement, evaluation, and response to individual student data at Tier 2. One additional item was open-ended. Content analysis for the open-ended item, answered in the Tier 1 section by all respondents, is summarized in the text of Chapter 4 to describe the measures practitioners reported using for formative assessment. Open-ended responses are detailed in Appendix H (Table H.4).

Research question #2. What are teachers' perceptions of the impact their DBIDM practices have on student learning?

There was one survey item related to the second research question, describing teacher perceptions of the impact their DBIDM practices have on student learning. A summary of the variables, values, and value descriptions related to this research question are provided as Appendix G (Table G.2). This item was a close-ended, 4-point Likert scale item from the Tier 1 section, which will be answered by all participants. Descriptive statistics are reported for the level of impact that teachers report their data use practices have on student learning outcomes.

Research question #3. What are teachers' perceptions of the importance of and their preparation for progress monitoring as part of DBIDM?

Three survey items from the Tier 1 and Tier 2 section were related to the third research question, describing teacher perceptions of DBIDM practices and their knowledge of evidence-based practices in progress monitoring. A summary of the variables, values, and value descriptions related to this research question are provided as

Appendix G (Table G.3). Each of these were close-ended, Likert-scale items (two 4-point, the other 5-point). Descriptive statistics are reported for perceived importance of frequent, direct progress monitoring; and level of preparation for aspects of evidence-based practice in progress monitoring.

Research question #4. What are teachers' perceptions of factors, barriers, and school-based supports for their use of DBIDM practices?

There were 11 items related to the fourth research question, describing teacher perceptions of the relationship between their use of DBIDM practices and school-based supports. A summary of the variables, values, and value descriptions related to this research question are provided as Appendix G (Table G.4). Seven of the items were close-ended, including the two close-ended items in the RTI Model section, as well as one checklist item, two 4-point Likert-scale items, and two frequency scaled items (each with 9 choices) from the Tier 1 and Tier 2 sections. Descriptive statistics are reported for the approach and data decision rules used within schools' RTI models; required frequency of measurement (i.e., school wide progress monitoring schedule and expectations); perceived utility of data from major data sources/assessment measures; and overall availability of supports for data use practices within the school setting. The remaining four items were open-ended, with two answered in the Tier 1 section and two answered in the Tier 2 section in relation to barriers and supports. Content analysis for these items are summarized in Chapter 4 to describe practitioner reported barriers to data use and suggestions for support needs to improve their ability to use data formatively to plan and provide effective instruction within Tiers 1 and 2. Open-ended responses are detailed in Appendix H (Tables H.8, H.9, H.10, and H.11).

Research question #5. What is the relationship between teachers' reported DBIDM practices within Tier 1 of RTI, and their perceptions of the impact of these practices on student learning, importance of and preparedness for progress monitoring, and school-based supports?

Twenty-six existing variables from seven survey items in the RTI Model and Tier 1 sections of the survey were used to create the nine variables related to teachers' reported DBIDM practices within Tier 1 of RTI, and their reported perceptions of contributing data-use factors. A logistic regression model was fit to the data and used to investigate the impact of four dichotomous independent variables, while controlling for two control variables, on a dichotomous dependent variable. A summary of the initial and created variables, values, and value descriptions related to this research question are provided as Appendix G (Table G.5).

The dependent variable was teacher's reported data-based instructional decision-making (DBIDM) within Tier 1 that includes both measurement and evaluation as recommended best practice. Within Tier 1, recommended best practice includes benchmark and frequent progress monitoring using CBM, 2 - 4 times per year or more frequently during measurement; and the use of data for targeting skills/focus areas of academic need, evaluating the effectiveness of instruction, and making adjustments to instruction during evaluation.

The four independent variables were teachers' reported perceptions of data-use factors including (a) importance of progress monitoring, (b) preparation for aspects of progress monitoring, (c) currently available school-level supports, and (d) impact of their data measurement and evaluation practices on student outcomes. The two control variables were specific to the RTI model implemented in teachers' schools including the approach and standard data-decision rules used within the models. These control variables were included in order to better examine the direct influence of teachers' reported perceptions of data-use factors on teachers' reported DBIDM practices, regardless of the school's model. Initially, there was a plan to include two additional control variables from the demographic section of the survey. However, the sample size was too small to do so based on the number of teachers that responded to demographic items. In addition, controlling for years of teaching experience and certification method was not as beneficial as controlling for schools' RTI model approach and rules, which are school-level factors that may relate more directly to classroom level DBIDM practices.

Initially, there was a plan to run six logistic regression models to examine measurement, evaluation, and DBIDM at both Tiers 1 and 2. However, the sample size was too small, based on the number of teachers that responded to items within the Tier 2 section of the survey, to model each of these at Tier 2. In addition, most teachers reported measurement using CBM that was aligned with recommended practice and data-use practices that were aligned with recommended best practice at Tier 1. Therefore, it was not possible to model for measurement and evaluation individually. Of interest in this model, is DBIDM at Tier 1 that includes both measurement *and* evaluation that is aligned with recommended best practice. Because more teachers reported both measurement and evaluation in accordance with best practice, this model was used to estimate the probability of a negative outcome or the non-event (i.e., teachers' reporting DBIDM practices including measurement and/or evaluation that is not in aligned with recommended best at Tier 1). The non-event (T1dbidm = 0) therefore included measurement with CBM *less frequently* than the recommended 2 - 4 times per year; and evaluation in which data were not used to target skills, evaluate instructional effectiveness, *and* adjust instruction. Descriptive statistics, data for variables used within the logistic regression, and inferential statistics are reported within the text of Chapter 4 and in Appendix H (Tables H.14 and H.15).

Reliability and Validity

Survey development, data collection, and data analysis procedures were followed as designed to avoid possible threats and to test the validity of this study. A pilot test of the survey instrument helped to identify any issues with the design and content of the survey instrument prior to distributing the survey to study participants. The use of a web-based, self –administered or computer assisted, survey instrument as the mode of data collection ensured that responses were recorded directly, which almost eliminated data entry errors. In addition, this mode of data collection allowed participants to submit responses anonymously, which encouraged not only a higher rate of response but also responses that were accurate and honest.

Because responses were collected from a sample rather than each individual in the target population, some variation between the characteristics of the sample and the target population (i.e., sampling error) is to be expected by chance alone (Fowler, 2014). To minimize potential sampling errors, the sample frame was designed to include all K-3 general education teachers in 35 principal-approved schools within the four identified school districts in the state, that currently implement RTI: a) district-wide (e.g., in all primary and elementary schools); and b) school-wide for providing tiered academic instruction and interventions at each grade level.

Potential bias, or differences in this sample population and the target population may arise as a result of including teachers only from districts implementing RTI district-wide (Fowler, 2014). The information provided by participants in this study may not match the insight of teachers in schools where RTI is being implemented without being part of a district-wide initiative. In addition, K-3 general education teachers within districts and schools identified for participation in this study who responded to the survey may provide information that differs from the views of those that did not respond.

Summary

Six hundred twenty K-3 general education teachers from 35 primary/elementary schools across four South Carolina school districts were invited to participate in the current study. Data collection occurred over a three-month period in two rounds, each lasting four weeks, during which time four email contacts were made with teachers regarding participation in this study by completing the web-based survey. Of the 620 teachers in the study population, 224 completed the survey. Of this number, 163 were included in the analysis for research questions 1 through 4, and 152 were included in the analysis for research question 5. Quantitative analyses were used to investigate the five research questions in this study. Descriptive statistics were used to analyze data related to research questions 1 through 4. Inferential statistics were used to analyze data related to research question 5. Content analysis was used to analyze the open-ended items related to research questions 1 through 4. The results of these analyses are presented in the following chapter within the text and in tables, as well as in Appendix H.

CHAPTER 4

Results

The purposes of this study were to investigate the current DBIDM practices of general education teachers within their elementary school's RTI model at Tiers 1 and 2, and to determine the relationship between teachers' reported DBIDM practices and perceptions of data-use factors within Tier 1. My goals in this study were to describe (a) how teachers report using data from assessments of student performance and progress to plan effective instruction and interventions; (b) teachers' perceptions of their DBIDM practices in terms of experience, knowledge, training, support, and effect on student learning outcomes; and (c) how teachers' perceptions influence their DBIDM practices at Tier 1. A survey was used to gather information for the purposes and goals of this study.

The purpose of this chapter is to present the findings. The chapter begins with a description of the sample, which is followed by the results obtained in each of the five analyzed research questions addressed in this study.

Description of the Sample

The web-based survey was sent to a total of 620 general education teachers, grades K-3, in 35 primary/elementary schools across four school districts in South Carolina. Data from 163 of the 224 participants were used for analysis in research questions 1 through 4 (73% of the completed sample). After removing missing observations from the first analyzed data set for each of the variables used in the logistic regression model, data from 152 participants were used for analysis in research question 5 (68% of the completed sample).

The survey included a section containing eight items to gather demographic information. A summary of participants' demographic characteristics is provided in Appendix H (Table H.1). Because a response to these items was encouraged, but not required, only 140 - 141 of the 224 participants (63%) provided responses to at least one of the items in the demographics section. Participants represented a fairly even range in both years of teaching experience and grade levels currently taught. Most participating teachers reported being certified in general education and having earned a Master's level degree through a graduate teacher preparation program. More teachers reported being a part of District D than any other, which corresponds to the district with the higher percentage of school participation (75% of all primary and elementary schools in the district). However, due to the small number of teachers that identified their district in this item, all frequencies do not correspond with district-wide/school participation levels.

Analysis of Research Questions

Research Question #1. The first research question investigated in this study focused on teachers' reported DBIDM practices: How do teachers report using data formatively to make classroom-level instructional decisions for students at Tiers 1 and 2 of their school's RTI model?

Measurement and Evaluation at Tier 1. In the Tier 1 section of the survey, teachers were asked how often (never, annually, 2-4 times per year, monthly, bi-weekly, weekly, 2-3 times per week, daily) they typically administer ten common types of assessments to monitor student progress within Tier 1. All frequency counts and percentages for each assessment and frequency of administration are detailed in Appendix H (Table H.2). The frequency counts for teachers reporting the use of CBM and the use of informal measures within Tier 1 is illustrated in Figures 4.1 and 4.2 respectively.

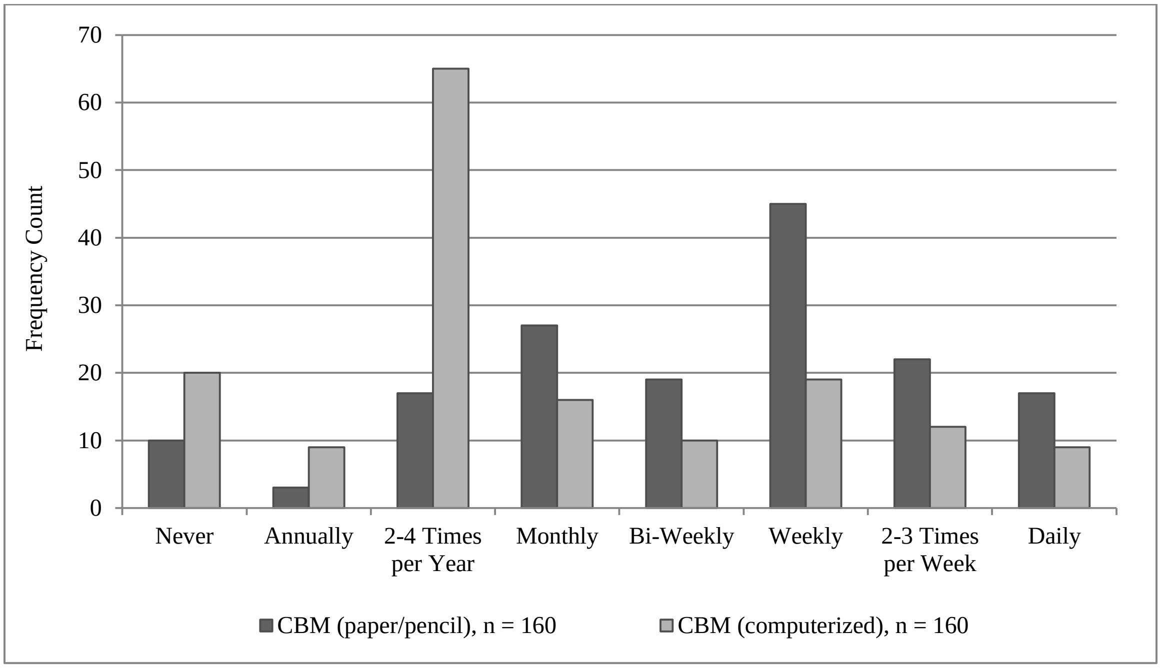

Figure 4.1 Teachers' reported frequency of administering CBM at Tier 1.

The majority of teachers (92%) reported using paper/pencil CBM *2 - 4 times per year* or more frequently to monitor student progress at Tier 1. Eighty-two percent of teachers also reported using computerized CBM *2 - 4 times per year* or more frequently. *Weekly* CBM use (including both paper/pencil and computer format) was reported by only 40% of teachers for frequent progress monitoring within Tier 1.

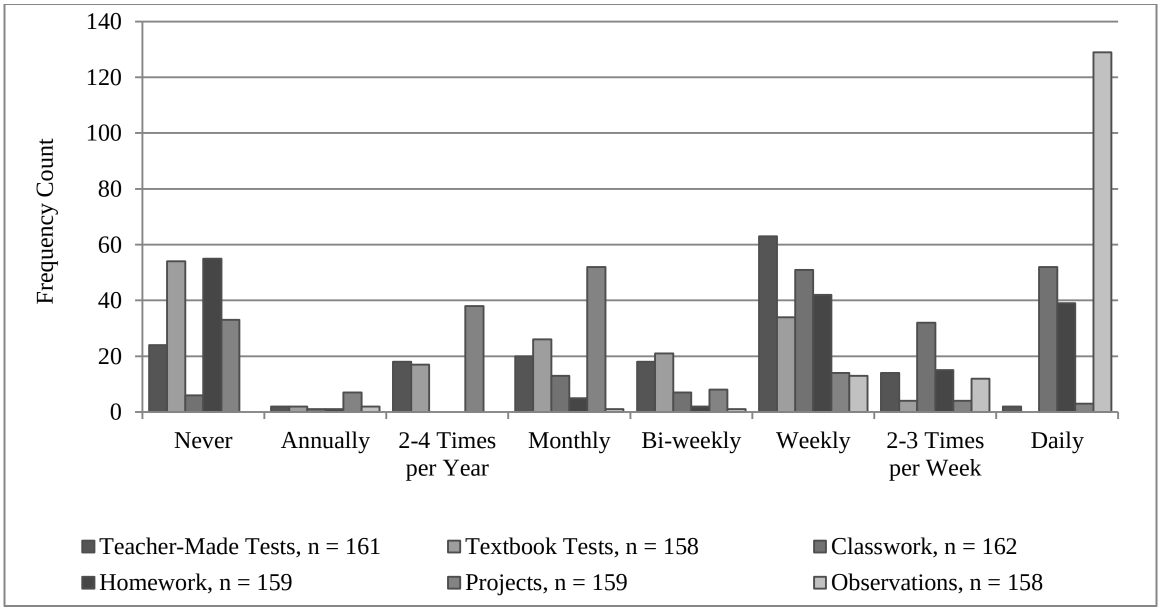

Figure 4.2 Teachers' reported frequency of administering informal assessments at Tier 1.

The majority of teachers (82%) most often reported *daily* use of observations, which was the highest and most frequent use reported across all listed assessments. *Weekly* use across assessments including teacher-made tests, textbook tests, classwork, and homework was also reported by 22% to 39% of teachers. Thirteen teachers responded "Other" providing an open-ended response for this item. Some teachers, but not all, included the frequency of administration and a specific assessment name. The frequency counts and percentages for open-ended responses are detailed in Appendix H (Table H.3).

Teachers were also asked to list the formative assessments they used in their classroom to inform daily instructional planning within Tier 1, being sure to include specific names when possible. Because most teachers provided multiple assessments types/names, there were a total of 424 individual response items. The frequency counts and percentages of open-ended responses provided by 132 teachers for this item are detailed in Appendix H (Table H.4). There was a great deal of variation in what teachers reported as formative assessments. Responses ranged from informal formative assessment strategies and checks for student understanding such as observations or conferences, whiteboard checks, and "Thumbs up/thumbs down"; to curricula and instructional programs such as Wilson Foundations, ReadWell, and Everyday Math. Some of the listed assessments and assessment strategies appeared in multiple teachers' descriptions. For example, 37 teachers listed DIBELS and 27 teachers listed Measures of Academic Progress (MAP) as well as general district assessments. Within the strategies listed for informal checks for understanding, 24 teachers listed observation as the formative assessment they use daily in the classroom. In addition, although teachers were not asked to provide formative assessments related to specific content areas, more teachers responded providing assessments and/or instructional programs in reading than in math or writing.

Teachers were asked how they record data from assessments of student progress for use during their instructional planning within Tier 1. The frequency counts and percentages for this item are displayed in Table 4.1. The majority of teachers reported that they record data as anecdotal notes (78%). Fourteen teachers responded "Other" for this item, providing an open-ended response. Some teachers provided multiple descriptors, so there were a total of 18 individual response items. Three teachers listed progress of mastery scales/proficiency rubrics (i.e., 1 = Needs More Instruction/Beginning to Learn Standard; 2 = Partially Proficient; 3 = Proficient) for recording data. Two teachers each listed standards-based grading (i.e., mastered/not mastered), item analysis by individual student, and number correct out of total items (not a percentage) as their method of recording data. The remaining responses included class/grade level average, notebooks, scoring sheets, checklists, running records, portfolio pieces and student conferences.

Table 4.1

Method of Recording Data from Assessments at Tier 1

Recording Method/Type	*f*	%
Letter Grades	47	28.83
Number Grades	70	42.94
Anecdotal Notes	127	77.91
Percent Correct	83	50.92
Percent Complete	22	13.50
Raw Score	24	14.72
Computerized Software	44	26.99

Note. n = 163. Item was “Mark All that Apply”, *f* and (%) values are for teachers selecting each recording method/type.

Teachers were asked how often they graph student performance/progress results within Tier 1. Table 4.2 displays the frequency counts and percentages for this item. More teachers reported that they only graph results *sometimes*, which was higher than for any other frequency (29%). It would seem, however, that only about one-third of teachers may be graphing at all (frequently or infrequently) because this was most closely followed by 21% and 26% of teachers that reported they either *never* or *consistently* graphing results of student performance/progress within Tier 1.

Table 4.2

Frequency of Graphing Student Performance/Progress at Tier 1

Graphing Frequency	*f*	%
Never	35	21.47
Occasionally, when I remember	10	6.13
Sometimes, when I am required to prior to a team/parent meeting	48	29.45
Consistently, following each measure/assessment and scoring	43	26.38
Computerized data software automatically graphs each measure/assessment when completed	27	16.56

Note. n = 163. Item was "Mark All that Apply", *f* and (%) values are for teachers selecting each graphing frequency.

Teachers were then asked to indicate the reason(s) they opt not to graph data from assessments of student performance/progress if they do not always do so. Table 4.3 shows the frequency counts and percentages for this item. Almost half of the teachers reported that it is *not necessary to graph student performance* (49%). Twenty-six teachers selected "Other", providing open-ended responses resulting in a total of 31 individual response items. The frequencies and percentages for teachers' open-ended responses to this item are detailed in Appendix H (Table H.5). Some teachers described using alternatives to graphing such as data notebooks, grades, and student portfolios. Other responses suggested graphing was not helpful, was too time consuming, or that the teacher was either not prepared for or aware of the graphing process.

Table 4.3

Reasons for Not Always Graphing Student Progress at Tier 1

Reason for Not Always Graphing	*f*	%
Not Necessary to Graph Student Progress	42	49.41
Graphing is Too Time Consuming	36	42.35
Graphed Results are Too Difficult to Interpret	6	7.06
Unsure of How to Graph Student Progress	14	16.47

Note. n = 85. Item was "Mark All that Apply", *f* and (%) values are for teachers selecting each reason for not graphing.

In terms of evaluation practices, teachers were asked how often they review student progress data for their instructional planning within Tier 1. Table 4.4 displays the frequency counts and percentages for this item. The majority of teachers reported that they review data of student performance/progress *weekly* or more frequently on their own (83%). Most teachers (75%) reported data review with colleagues occurring between *monthly* and *weekly*, although the frequency was more varied than for reviewing data on their own.

Table 4.4

Frequency of Data Review for Instructional Planning at Tier 1

Frequency of Review	Review on Own	Review with Colleagues [a]
	f (%)	*f* (%)
Never	0 (0.00)	1 (0.62)
Annually	1 (0.64)	2 (1.24)
2 – 4 Times per Year	6 (3.82)	19 (11.80)

Monthly	8 (5.10)	43 (26.71)
Bi-Weekly	11 (7.01)	16 (9.94)
Weekly	79 (50.32)	61 (37.89)
2 – 3 Times per Week	25 (15.92)	19 (11.80)
Daily	27 (17.20)	0 (0.00)

Note. n = 157.
[a] n = 161.

Teachers were also asked how often they use data from state, district, and frequent progress monitoring assessments for instructional planning at Tier 1. Table 4.5 shows the frequency counts, percentages, means and standard deviations for this item. The majority of teachers (91%) reported *often* or *almost always* using data from frequent progress monitoring to plan instruction for all learners at Tier 1 (Mean = 3.42, SD = 0.71).

Table 4.5

Level of Use for Data from Major Assessment Types at Tier 1

Assessments	Never *f* (%)	Sometimes *f* (%)	Often *f* (%)	Almost Always *f* (%)	*Mean*	*SD*
Annual State	34 (21.38)	51 (32.08)	49 (30.82)	25 (15.72)	2.41	0.99
District Benchmark [a]	9 (5.63)	42 (26.25)	74 (46.25)	35 (21.88)	2.84	0.83
Frequent Progress	3	12	59	85	3.42	0.71

Monitoring	(1.89)	(7.55)	(37.11)	(53.46)

Note. n = 159.
[a] n = 160.

Table 4.6 displays frequencies and percentages for the purposes or ways in which teachers reported using data from assessments of student performance/progress to plan effective instruction within Tier1. A fairly even distribution of using data for each of the purposes was reported by the majority of teachers (71-96%), except for the purposes of *promoting maintenance of mastered skills* (54%) and *selecting appropriate curricula* (53%).

Table 4.6

Data Use Types/Purposes at Tier 1

Data Use Type/Purpose	*f*	%
Selecting Appropriate Curricula	87	53.37
Differentiating Instruction	157	96.32
Identifying Instructional Groups	158	96.93
Focusing Instruction on Targeted Skills/Objectives	143	87.73
Promoting Maintenance of Mastered Skills	88	53.99
Providing Students with Feedback on Progress/ Reinforcement for Academic Behaviors	116	71.17
Evaluating the Effectiveness of Instruction	130	79.75
Adjusting Instructional Practices	130	79.75

Note. n = 163. Item was “Mark All that Apply”, *f* and (%) values are for teachers selecting data use type/purpose.

Measurement and Evaluation at Tier 2. In the Tier 2 section of the survey, teachers were asked about steps in their measurement practice. Table 4.7 displays the frequency counts and percentages for this item. Almost three-fourths of the teachers (70%) reported that their measurement practices included *administering and scoring CBM*, either by hand or using computerized data software. However, only 20% reported *frequently measuring progress (at least weekly) using CBM;* and less than half of teachers reported *graphing student performance after each measurement* (43%). Seven teachers responded "Other" to this item, of which five reported that measurement within Tier 2 is completed by others (individuals on the RTI team or interventionists) and shared with them.

Table 4.7

Steps When Measuring Student Progress within Tier 2

Measurement Step	*f*	%
Administering and Scoring CBM	18	25.71
Using Computerized Data Software to Administer and Score CBM	31	44.29
Frequently Measuring Progress Using CBM (at least weekly)	14	20.00
Use of Progress Monitoring Data to Set Goals	62	88.57
Use of Progress Monitoring Data to Target Skills	58	82.86
Graphing Student Performance After Each Measurement	30	42.86

Note. n = 85. Item was "Mark All that Apply", *f* and (%) values are for teachers selecting each measurement step.

Teachers were also asked how often they use data from state, district, and frequent progress monitoring assessments in their classroom to plan effective supplemental instruction and interventions within Tier 2. Table 4.8 shows the frequency counts, percentages, means and standard deviations for this item. The majority of teachers (89%) reported *often* or *almost always* using data from frequent progress monitoring to plan supplemental instruction/interventions for students at Tier 2. However, the reported use of frequent progress monitoring data was slightly lower, on average, at Tier 2 (Mean = 3.38, SD = 0.71) than at Tier 1.

Table 4.8

Level of Use for Data from Major Assessment Types at Tier 2

Assessments	Never *f* (%)	Sometimes *f* (%)	Often *f* (%)	Almost Always *f* (%)	*Mean*	*SD*
Annual State	18 (22.50)	25 (31.25)	27 (33.75)	10 (12.50)	2.36	0.96
District Benchmark	4 (5.00)	20 (25.00)	37 (46.25)	19 (23.75)	2.89	0.82
Frequent Progress Monitoring	1 (1.25)	8 (10.00)	31 (38.75)	40 (50.00)	3.38	0.71

Note. n = 80.

Teachers were also asked about the ways or purposes for which they use data at Tier 2. Table 4.9 shows the frequency counts and percentages for this item. Similar to results at Tier 1, more than half of the teachers (69-97%) reported using data from assessments of student performance/progress in each of the ways included in the item at Tier 2. Teachers within Tier 2, however, reported the purposes of *evaluating the* *effectiveness of chosen interventions* (69%) and *providing students with feedback on performance/reinforcement for academic behaviors* (70%) least often. In addition, two teachers responded "Other" to this item and provided an open-ended response. Both responses stated that interventionists are responsible for planning/deciding what intervention(s) a student receives.

Table 4.9

Data Use Types/Purposes at Tier 2

Data use Type/Purpose	*f*	%
Selecting Appropriate Progress Monitoring Measures	56	72.73
Determining Students' Academic Needs	73	94.81
Identifying Instructional Groups	75	97.40
Selecting Interventions and Instructional Strategies	65	84.42
Determining Students' Responsiveness to Instruction and Interventions	57	74.03
Determining When Changes to Instruction and Interventions are Needed	61	79.22
Providing Students with Feedback on Performance/Reinforcement for Academic Behaviors	54	70.13
Evaluating the Effectiveness of Chosen Interventions	53	68.83

Note. n = 77. Item was "Mark All that Apply", *f* and (%) values are for teachers selecting data use type/purpose.

Within the Tier 2 section of the survey, teachers were asked two additional questions related to steps in their evaluation practices. The frequency counts and percentages for steps teachers reported being part of their evaluation of and response to student progress data within Tier 2 are displayed in Tables 4.10 and 4.11 respectively.

Table 4.10

Steps When Evaluating Student Progress Data within Tier 2

Step in Evaluating Student Progress	*f*	%
Own Review of Graphed Student Progress Monitoring Data Frequently (at least once a week)	30	42.25
Team Review of Graphed Student Progress Monitoring Data Frequently (at least once a week)	42	59.15
Applying Standard Data Decision Rules to Determine the Effectiveness of Current Instruction	40	56.34
Applying Standard Data Decision Rules to Determine When and If Adjustments are Needed	43	60.56
Using Computerized Data Software that Automatically Applies Standard Data Decision Rules	22	30.99

Note. n = 71. Item was "Mark All that Apply", *f* and (%) values are for teachers selecting each step in evaluating progress.

Most teachers (56-61%) reported *frequent review (at least weekly) of graphed student data with a team of colleagues* during which they apply standard data decision rules for determining the effectiveness of instruction and/or when and if changes are needed. Fewest teachers reported using *computerized data software that automatically applied standard data decision rules* (30%) within Tier 2. Three teachers also responded "Other", stating that an RTI team handles this component in their school.

Table 4.11

Steps When Responding to Student Progress Data Within Tier 2

Step in Responding to Student Progress	*f*	%
Continuing Current Instruction	37	50.68
Adjusting Instruction by Making Changes to One Feature at a Time	58	79.45
Discontinuing/Decreasing Intensity of Current Instruction	21	28.77
Increasing the Intensity of Support	40	54.79
Monitoring Progress Continuously	50	68.49
Following Instructional Recommendations Provided by Staff Supports	53	72.60
Following Instructional Recommendations Provided by Computerized Supports	22	30.14

Note. n = 70. Item was "Mark All that Apply", *f* and (%) values are for teachers selecting each step in responding to progress.

Most teachers (50-79%) reported a fairly even distribution across most response steps. Only 29%, however, reported *discontinuing/decreasing the intensity of current instruction* within Tier 2 after reviewing student data (i.e., moving back to Tier 1). Similar to responses in the previous item, fewer teachers reported following instructional recommendations provided by computerized supports, and two teachers responded "Other" stating that an RTI team in their school handles this component.

Research Question #2. The second research question investigated in this study was: What are teachers' perceptions of the impact their DBIDM practices have on student learning? In the Tier 1 section of the survey only, teachers were asked about the level of impact (no impact, slight impact, neutral, moderate impact, extreme impact) their frequent assessment and monitoring of student progress has on student outcomes. All frequency counts, percentages, means and standard deviations for teachers' perceived impact on various aspects of student learning are detailed in Appendix H (Table H.12). Frequency counts are illustrated in Figure 4.3.

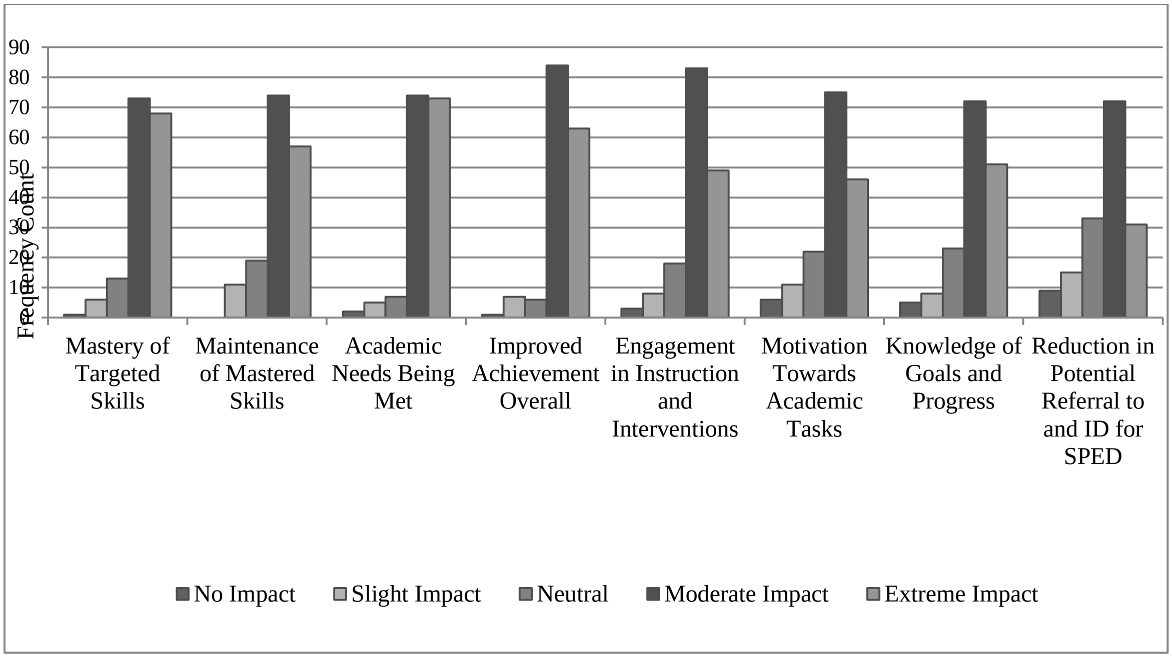

Figure 4.3 Teachers' reported level of impact on student outcomes.

Most teachers reported a *moderate* to *extreme* perceived impact, as a result of their DBIDM practices including frequent assessment and monitoring of student progress, on each of the student learning outcomes included in this item. Perceived impact on students' needs being met through differentiated/targeted instruction and intervention was higher on average than for any other student outcome (Mean = 4.31, SD = 0.80). Teachers' perceived impact on a reduction in students' potential referral for special education and related services was, however, lower on average and more varied than for any other student outcome (Mean = 3.63, SD = 1.07). In fact, 35% of teachers reported *neutral*, *slight*, or *no impact* for this student learning outcome.

Research Question #3. The third research question investigated in this study was: What are teachers' perceptions of the importance of and their preparation for progress monitoring as a part of DBIDM? Items from both the Tier 1 and Tier 2 section of the survey were used to investigate this question.

Importance of Progress Monitoring at Tier 1. In the Tier 1 section of the survey, teachers were asked about the level of importance (not, slightly, moderately, extremely) for direct, frequent assessment and monitoring of student progress. Table 4.12 displays the frequency counts, percentages, means and standard deviations for this item. The majority of teachers (69 - 79%) reported the perception that direct, frequent progress monitoring is *extremely important* to their classroom level decision-making for both class-wide and individual instructional decisions at Tier 1. On average, the level of importance was slightly higher for individual instructional decisions (Mean = 3.78, SD = 0.47) than for class-wide instructional decisions (Mean = 3.62, SD = 0.62).

Table 4.12

Level of Importance for Direct, Frequent Monitoring of Student Progress at Tier 1

Instructional Decision	Not Important *f* (%)	Slightly Important *f* (%)	Moderately Important *f* (%)	Extremely Important *f* (%)	*Mean*	*SD*
Class-wide	1 (0.62)	9 (5.59)	40 (24.84)	111 (68.94)	3.62	0.62
Individual [a]	1 (0.63)	1 (0.63)	31 (19.38)	127 (79.38)	3.78	0.47

Note. n = 161.
[a] n = 160.

Importance of Progress Monitoring at Tier 2. In the Tier 2 section of the survey, teachers were asked the same question about the level of importance for direct, frequent assessment and monitoring of student progress. Most teachers (62%), although fewer than in Tier 1, reported the perception that direct, frequent progress monitoring is *extremely important* to their decision-making within Tier 2. Likewise, the level of importance reported by teachers at Tier 2 (Mean = 3.59, SD = 0.54) was lower on average than at Tier 1.

Preparation for Progress Monitoring. In the Tier 1 section of the survey only, teachers were asked about their perceived level of preparation for all aspects of progress monitoring. The frequencies, percentages, means and standard deviations for this item are detailed in Appendix H (Table H.13), with frequency counts illustrated in Figure 4.4.

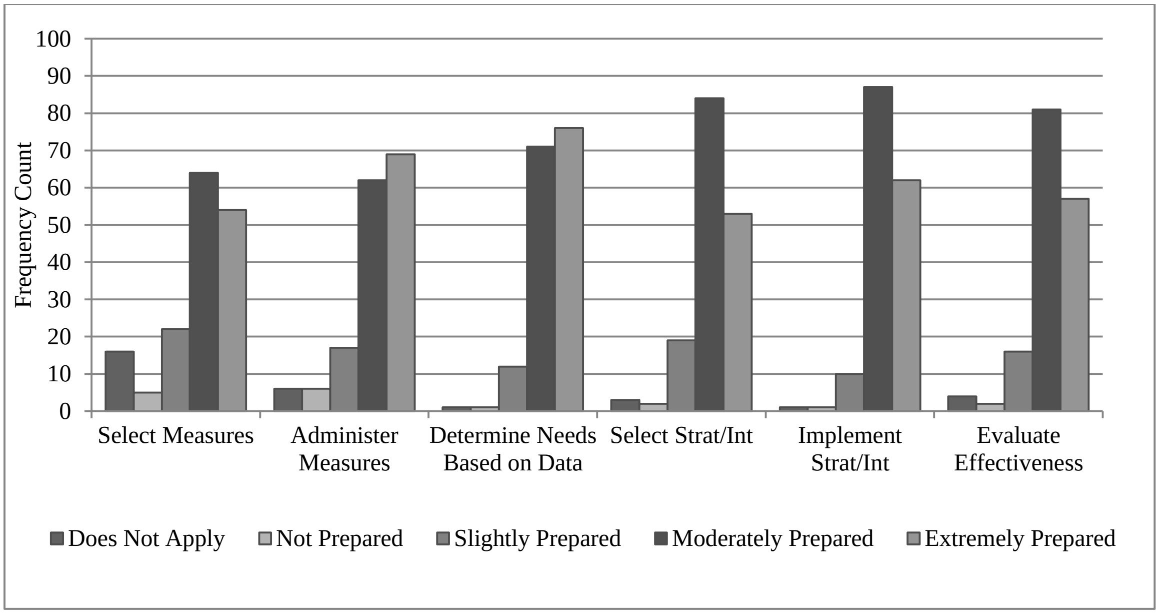

Figure 4.4 Teachers' reported level of preparation for progress monitoring steps.

The majority of teachers (73 - 93%) reported being *moderately* to *extremely prepared* for aspects of progress monitoring. On average, reported preparation was highest for determining academic needs based on data of student performance (Mean =

3.37, SD = 0.70). Reported preparation was lowest, however, for selecting progress monitoring measures (Mean = 2.84, SD = 1.21), for which nearly one-third of teachers reported low to no preparation or that it *does not apply to their current teaching role*.

Research Question #4. The fourth research question investigated in this study was: What are teachers' perceptions of factors, barriers, and school-based supports for their use of DBIDM practices? Items from all three sections of the survey were used to investigate the focus of this question.

Factors related to Implemented RTI Models. In the first section of the survey, teachers were asked about the RTI model approaches implemented in their schools and the standard data-decision rules used within the RTI models at various decision-making points. The frequency counts and percentages are shown for reported approaches and data rules in Tables 4.13 and 4.14 respectively.

Table 4.13

RTI Model Approaches Implemented in Teachers' Schools

Approach	*f*	%
Don't Know	6	3.73
Standard Treatment Protocol	57	35.40
Problem Solving	46	28.57
Hybrid – combination of Standard Treatment Protocol and Problem Solving	49	30.43
Other	3	1.86

Note. n = 161.

Table 4.14

Standard Data-Decision Rules within Implemented RTI Models

Decision-Making Points	Don't Know *f* (%)	No Standard Rules *f* (%)	Level *f* (%)	Gap Analysis *f* (%)	Growth *f* (%)	Level and Growth *f* (%)
ID "At-Risk" Students	17 (10.43)	5 (3.07)	79 (48.47)	5 (3.07)	8 (4.91)	49 (30.06)
Adjust Instruction/ Interventions	16 (9.82)	6 (3.68)	34 (20.86)	7 (4.29)	36 (22.09)	64 (39.26)
Determine Movement Between Tiers	17 (10.43)	2 (1.23)	39 (23.93)	7 (4.29)	46 (28.22)	52 (31.90)
ID SLD/Eligibility Decisions [a]	32 (19.75)	4 (2.47)	36 (22.22)	26 (16.05)	11 (6.79)	53 (32.72)

Note. n = 163. ID = Identify(ing).
[a] n = 162.

As shown in Table 4.13, there was a fairly even distribution reported across models, with slightly more teachers reporting the use of a standard treatment protocol approach (35%). As shown in Table 4.14, more teachers (32-39%) reported the use of standard data-decision rules based on *Level and Growth* (i.e. dual discrepancy) for most decision-making points. However, for decision related to identifying students as at-risk, more teachers (48%) reported the use of rules based on *Level*. Standard data-decision rules reported by teachers at each decision point varied, however, with most variation seen between (a) the use of rules based on *Level, Growth,* or a combined *Level and*

Growth; and (b) between standard data-decision rules used for making decisions regarding SLD identification and eligibility.

Factors, Barriers, and Supports at Tier 1. In the Tier 1 section of the survey, teachers were asked about the frequency of assessment required within their school's RTI models. All frequency counts and percentages for this item are detailed in Appendix H (Table H.6). Teachers' reported assessment requirements varied across all frequencies and between class-wide and individual requirements. It appears that in most teachers' schools the frequency requirement for assessing all students is somewhere between *2-4 times per year* and *weekly* (16-36%); and the frequency requirement for assessing students identified as potentially at-risk is somewhere between *monthly* and *weekly* (14-27%).

Teachers were also asked about school-level supports currently available to support their DBIDM practices. Table 4.15 displays the frequency counts and percentages for teachers' responses to this item. The majority of teachers (61-91%) reported the current availability of all school-level supports listed in the item response choices. There was a fairly even distribution across the supports, except for *computerized supports without instructional recommendations* (45%), to support their DBIDM practices at the classroom level.

Table 4.15

Currently Available School-Level Supports

School-Level Support	*f*	%
Professional Development in Using Student Data for Classroom Level Instructional Decision-Making	131	81.88

Staff Supports for Analyzing and Responding to Student Data at the Classroom Level	145	90.63
Computerized Supports (data software *without* instructional recommendations)	72	45.00
Computerized Supports (data software *with* instructional recommendations)	97	60.63
Access to Materials for Collecting, Analyzing, and Responding to Student Data	108	67.50
Data Review and Instructional Planning with Colleagues	134	83.75
Administrative Leadership (including organized support and expectations for school-wide data-use)	121	75.63

Note. n = 160. Item was "Mark All that Apply", *f* and (%) values are for teachers selecting each school-level support.

In an open-ended item, teachers were asked to share their most important suggestion for supporting their ability to use data formatively to plan instruction within Tier 1. Although this survey item was intended to elicit responses that would describe teachers' needs in order to feel more supported in their classroom level DBIDM practices, some teachers had a different interpretation of the question. Because some teachers provided multiple suggestions and 10 teachers replied *N/A* or *None*, there were a total of 71 individual response items. The frequency counts and percentages of open-ended responses provided by 70 teachers for this item, organized by overarching categories and sub-categories, are detailed in Appendix H (Table H.7). Most teachers (57%) provided descriptive responses related to their needs at Tier 1, which included *time*

(31%); *knowledge, training and support* (19%); *materials and resources* (6%); and *class size* (1%). Other teachers described suggestions for what is working in their current data-use practices and the benefits of these practices, descriptions of their preferences on assessment/instruction practices, and general comments.

Teachers were also asked about their perceived utility of data resulting from state, district, and frequent progress monitoring assessments to instructional decision-making at Tier 1. Table 4.16 displays the frequency counts, percentages, means, and standard deviations for this item. Teachers reported agreement that data from all three assessments are useful in their daily instructional planning within Tier 1, although the majority of teachers (92%) reported that they *agree* or *strongly agree* that data from frequent progress monitoring are useful in their daily instructional planning. In fact, teachers' perceived utility of data resulting from frequent progress monitoring (Mean = 3.32, SD = 0.65) was higher than data resulting from both district benchmark assessments and annual state assessments.

Table 4.16

Utility of Data from Major Assessment Types to Instructional Decision-Making at Tier 1

Assessments	Strongly Disagree *f* (%)	Disagree *f* (%)	Agree *f* (%)	Strongly Agree *f* (%)	*Mean*	*SD*
Annual State [a]	16 (10.06)	46 (28.93)	86 (54.09)	11 (6.92)	2.58	0.76
District Benchmark [b]	2 (1.25)	21 (13.13)	113 (70.63)	24 (15.00)	2.99	0.58

Frequent Progress Monitoring	2 (1.23)	11 (6.79)	82 (50.62)	67 (41.36)	3.32	0.65

Note. n = 162.
[a] n = 159. [b] n = 160.

In an open-ended item, teachers were asked to describe the most significant barrier that prevents them from using student progress data formatively to plan instruction for all students within Tier 1. Of the 92 teachers that provided a response for this item, fifteen teachers responded *N/A* or *none*, while others cited multiple barriers. The result was a total of 86 individual response items. The frequency counts and percentages of open-ended responses have been organized by overarching categories and sub-categories, which are detailed in Appendix H (Table H.8). The majority of teachers (72%) reported the most significant barrier to their using data from student progress monitoring formatively within Tier 1 as *time*. Other barriers described by teachers were related to *student and parent factors* (8%); *district and school factors* (7%); *and their own knowledge, training, and support* (7%).

Factors, Barriers, and Supports at Tier 2. In the Tier 2 section of the survey, teachers were asked about the frequency of assessment and review required within their school's RTI Models. All frequency counts and percentages for each required assessment and review frequency are detailed in Appendix H (Table H.9). Teachers' reported assessment and data review requirements varied across all frequencies. It appears that in most teachers' schools the frequency required within Tier 2 for both assessing and reviewing data of students' performance and progress is somewhere between *monthly* and *weekly* (20-25%).

In an open-ended item, teachers were asked to provide their most important suggestion for supporting their ability to use data formatively to plan supplemental instruction and interventions within Tier 2. As in Tier 1, interpretation of the question item resulted in varied responses, although this survey item was intended to elicit responses that would describe what teachers need in order to feel more supported in their classroom level data-use practices. Because eight teachers replied *N/A* or *None*, there were a total of 23 individual response items. The frequency counts and percentages of open-ended responses provided by 30 teachers for this item, organized by overarching categories and sub-categories, are detailed in Appendix H (Table H.10). Most teachers (56%) provided descriptive responses related to their needs, which included *time* (30%); *knowledge*, *training and support* (22%); and *needing more interventionists* (4%). Other teacher responses described suggestions for what is working in their current data-use practices and the benefits of these practices, preferences, as well as general comments.

Teachers were also asked about their perceived utility of data resulting from state, district, and frequent progress monitoring assessments to their instructional decision-making within Tier 2. Table 4.17 displays the frequency counts, percentages, means, and standard deviations for this item. Similar to Tier 1 results, teachers reported agreement that data from all three assessments are useful, although almost all of teachers (99%) reported that they *agree* or *strongly agree* that data from frequent progress monitoring are useful in their planning of supplemental instruction and interventions within Tier 2. Likewise, teachers' perceived utility of data resulting from frequent progress monitoring (Mean = 3.49, SD = 0.52) was higher than data from both district benchmark assessments and annual state assessments.

Table 4.17

Utility of Data from Major Assessment Types to Instructional Decision-Making at Tier 2

Assessments	Strongly Disagree *f* (%)	Disagree *f* (%)	Agree *f* (%)	Strongly Agree *f* (%)	*Mean*	*SD*
Annual State	12 (14.81)	22 (27.16)	35 (43.21)	12 (14.81)	2.58	0.91
District Benchmark	2 (2.47)	8 (9.88)	51 (62.96)	20 (24.69)	3.10	0.66
Frequent Progress Monitoring	0 (0.00)	1 (1.23)	39 (48.15)	41 (50.62)	3.49	0.52

Note. n = 81.

In an open-ended item, teachers were asked to describe the most significant barrier that prevents them from using student progress data formatively to plan supplemental instruction for students within Tier 2. Of the 38 teachers that provided a response for this item, eight teachers responded *N/A* or *none*, while others provided multiple barriers. The result was a total of 36 individual response items, for which the frequency counts and percentages of open-ended responses have been organized by overarching categories as detailed in Appendix H (Table H.11). Similar to results in Tier 1, the majority of teachers (64%) reported *time* as the most significant barrier to their using data from student progress monitoring formatively to plan supplemental instruction and interventions for students within Tier 2. Other barriers described by teachers were related to *district and school factors* (22%) and *student factors* (8%).

Research Question #5. The fifth research question investigated in this study was: What is the relationship between teachers' reported DBIDM practices within Tier 1 of RTI, and their perceptions of the impact of these practices on student learning, importance of and preparedness for progress monitoring, and school-based supports? Twenty-six variables resulting from seven survey items in the RTI Model and Tier 1 sections of the survey were used to create nine variables. These nine variables were used in order to investigate this research question.

A logistic regression model was fit to the data and used to investigate the impact of four dichotomous predictor variables on a dichotomous outcome variable (teachers' DBIDM within Tier 1 that includes both measurement and evaluation as recommended best practice). Predictor variables included teachers' perceived importance of progress monitoring, teachers' perceived preparation for aspects of progress monitoring, teachers' currently available school-level supports, and teachers' perceived impact of their measurement and evaluation practices on student outcomes. The model was used to estimate the probability of the non-event (i.e., teachers' reporting DBIDM practices that are not in accordance with recommended best practice for measurement and evaluation at Tier 1, DBIDM at Tier 1 = 0). Data used in the logistic regression model including the percent of yes and no responses for the dichotomous outcome and four predictor variables; and frequency counts, percentages, means and standard deviations for the two control variables are detailed in Appendix H (Tables H.14 and H.15) respectively.

Table 4.18 summarizes the results from three inferential statistics tests (likelihood ratio, score, and Wald test) used to examine the fit of the data in the logistic model as well as one goodness-of-fit test (H-L statistic) used to examine the fit of the model against actual outcomes.

Table 4.18

Inferential Statistics Results for Logistic Regression Model

Test	χ^2	*df*	*p*
Overall model fit			
Likelihood Ratio	13.0146	6	0.0428
Score	12.8786	6	0.0450
Wald	12.0414	6	0.0611
Goodness-of-fit test			
Hosmer &Lemeshow	7.4509	8	0.4889

Results from these tests revealed that the collective influence of the variables was statistically significant. The null hypothesis for the overall model, H_0: all βs = 0, was rejected. This implied that at least one predictor's regression coefficient ≠ 0 and that the logistic regression equation predicted the probability of the non-event better than the mean of the dependent variable y, χ^2 (6) = 13.0146, p = 0.0428. The results of the Hosmer-Lemeshow goodness-of-fit test, χ^2 (8) = 7.4509, p = 0.4889, suggested that the model fit the data well, therefore the null hypothesis, H_0: model fit, was plausible.

Chi-square tests were run to examine the statistical significance of individual regression coefficients, H_0: $\beta_{T1important} = 0$, H_0: $\beta_{prep} = 0$, H_0: $\beta_{impact} = 0$, H_0: $\beta_{support} = 0$, H_0: $\beta_{rti\_approach} = 0$, H_0: $\beta_{data\_rules} = 0$. These results revealed that only one of the predictors, preparation, was statistically significant at the .05 alpha level, χ^2 (1) = 5.8256, p = 0.0158, therefore the null hypothesis, $\beta_{prep} = 0$, was rejected. This implied that there was a linear relationship between teachers' perceived preparedness for aspects of progress monitoring and the non-event of practicing DBIDM that includes measuring and evaluating in accordance with recommended best practice at Tier 1. An additional predictor, impact, was statistically significant at the .10 alpha level, $\chi^2(1) = 2.7960$, $p = 0.0045$. This implied that there was also a linear relationship between teachers' perceived impact on student learning outcomes and the non-event of practicing DBIDM that includes measuring and evaluating in accordance with recommended best practice at Tier 1. The null hypothesis seemed plausible for the remaining predictors and control variables, implying there was not a linear relationship between the variables.

The results, which are summarized in Table 4.19, demonstrated that: Predicted logit of (T1dbidm) = 0.7178 + (- 0.2046)*T1important + (- 0.8950)*prep + (- 0.6223)*impact + (- 0.1368)*support + (0.0329)*rti_approach + (-0.0255)*data_rules.

Table 4.19

Logistic Regression Analysis of Teachers' Reported DBIDM Practice within Tier 1

Predictor	β	*SE* β	Wald's χ^2	*p*	Odds Ratio (e^{β})	95% Confidence Interval	
DBIDM at Tier 1	0.7178	0.6143	1.3655	0.2426			
Importance of PM	-0.2046	0.4752	0.1853	0.6668	0.815	0.321	2.069
Preparation for PM	-0.8950*	0.3708	5.8256	0.0158	0.409	0.198	0.845
Impact on Student Learning	-0.6223**	0.3722	2.7960	0.0945	0.537	0.259	1.113

Available School-level Supports	-0.1368	0.3752	0.1329	0.7155	0.872	0.418	1.820
RTI Approach	0.0329	0.1983	0.0276	0.8680	1.033	0.701	1.524
Data Decision Rules	-0.0255	0.0357	0.5089	0.4756	0.975	0.909	1.045

Note. n = 152. PM = progress monitoring
*p < .05. **p < .10.

According to the model, the log odds of non-DBIDM practice (i.e., DBIDM practice that does not include both measuring and evaluating according to recommended best practice within Tier 1) were negatively related to teachers' perceived preparedness for aspects of progress monitoring ($p < .05$). This means that for teachers who perceive high preparation for progress monitoring, there is a 59% decrease in the odds of reporting DBIDM practices that do not include measuring and evaluating as recommended best practice within Tier 1, while controlling for all other variables. This also means that for teachers who perceive low preparation for progress monitoring, there is a 145% increase in the odds of reporting DBIDM practices at Tier 1 that do not include measuring and evaluating as recommended practice. On average, nearly half (49%) of teachers in the analyzed sample who reported low preparation (feeling *not at all* or only *slightly prepared*) for *at least one* aspect of progress monitoring reported DBIDM practices that do not include measurement and evaluation as recommended best practice within Tier 1 of RTI. While just over one-fourth (26%) of teachers who reported high preparation (feeling *moderately* or *extremely* prepared) for *all* aspects of progress monitoring reported DBIDM practices that do not include measurement and evaluation as recommended best practice within Tier 1 of RTI.

There was also a negative relationship between the log odds of non-DBIDM practices and teachers' perceived impact on student learning outcomes ($p < .10$). Therefore, for teachers who perceive high impact on student learning outcomes, there is a 46% decrease in the odds of reporting DBIDM practices at Tier 1 that do not include measuring and evaluating as recommended practice. This also means that for teachers who perceive low impact on student learning outcomes, the odds increase by 86% for reporting DBIDM practices that do not include measuring and evaluating as recommended best practice within Tier 1, while controlling for all other variables. Forty-four percent of teachers in the analyzed sample reported low impact (feeling *no*, *slight*, to *moderate* impact) for *at least one* student learning outcome reported DBIDM practices that do not include measurement and evaluation as recommended best practice within Tier 1 of RTI. In comparison, one-fourth (26%) of teachers reporting high impact (feeling *extreme* impact) for *all* student learning outcomes, reported DBIDM practices that do not include measurement and evaluation as recommended best practice within Tier 1 of RTI.

Summary of Results

The current study described the practices and perceptions reported by K-3 general education teachers in 35 primary and elementary schools across 4 districts in the state of South Carolina. Teachers included in this sample represented a range in years of teaching experience and grade levels taught. Most teachers were certified in general education and held Master's level degrees earned through a graduate-level teacher preparation program.

The findings of this study were that K-3 general education teachers' reported measurement and evaluation practices varied greatly. They relied on informal and unsystematic measures of student progress more often than formative evaluation using

CBM, within Tiers 1 and 2 of RTI. CBM is being used for screening and benchmarking of all students within Tier 1. For frequent progress monitoring, however, CBM is not being used widely at Tier 1 and in alignment with all research-based recommendations at Tier 2. Teachers reported that their DBIDM practices have a high impact on the learning outcomes of students, but are less likely to reduce students' referral for evaluation for special education. While teachers see the value in and feel prepared for progress monitoring, preparation is lower for selecting appropriate progress monitoring measures. Teachers reported the availability of various school-level supports, however, reported overwhelmingly that time was a major barrier and support need within both tiers of RTI. In addition, study findings demonstrated a statistically significant relationship between K-3 general education teachers' reported DBIDM practices within Tier 1 and preparedness for all aspects or steps of progress monitoring, as well as perceived impact on student learning outcomes.

CHAPTER 5

Discussion

Data obtained from a web-based survey, completed by K-3 general education teachers within primary/elementary schools implementing RTI, were analyzed for this study. The purposes of this study were to (a) investigate the current DBIDM practices of general education teachers within their school's RTI model at Tiers 1 and 2, and (b) determine the relationship between teachers' reported perceptions of influential data-use factors, barriers, supports, and their reported DBIDM practice at Tier 1. In order to best prepare teachers for and support the use of DBIDM in the classroom, particularly within RTI, it is important to begin with an understanding of current teacher practice and how it currently aligns with evidence-based best practices described in the literature. There is evidence in the literature to support that when special education teachers have the appropriate training and support to apply the evidence-based protocol and procedures for DBIDM, their instruction is likely to be more effective. However, the same level of evidence does not exist for general education teachers and DBIDM within RTI.

The DBIDM practices of general education teachers have the potential to affect the learning outcomes of all students, including those with disabilities that are included in the general education setting. Within RTI specifically, general education teachers are responsible for instruction that should be adequate for at least 80% - 95% of students. This makes general education teachers' formative evaluation using CBM essential to both student learning outcomes and successful RTI implementation. In previous studies, the types of data available to and their use by general education teachers have only been described indirectly (Kerr et al., 2006; Marsh et al., 2006; Roehrig et al., 2008; Vernon-Feagans et al., 2012). To date, no studies have investigated (a) if general education teachers are using data from instructionally relevant assessment measures formatively; (b) how general education teachers' perceive their DBIDM in relation to experience, knowledge, training, and supports; and (c) how general education teachers' perceptions of components that contribute to effective data-use impact their DBIDM practices in the classroom, all particularly within RTI models. For these reasons, the current study focused primarily on (a) the cycle of collecting, analyzing, and responding to data at the classroom level; (b) perceptions of influential data-use factors, barrier and supports related to these practices; and (c) the relationship between data-use factors and teachers' DBIDM practice as reported by general education teachers currently providing instruction within Tiers 1 and 2 of the RTI model implemented in their school.

The purpose of this chapter is to discuss the research findings of this study. The chapter begins with a discussion of the findings. Then the limitations of the study, implications for practice, and directions for future research are discussed.

Discussion of the Findings

Research Question #1: How do teachers report using data formatively to make classroom-level instructional decisions for students at Tiers 1 and 2 of their school's Response to Intervention (RTI) model? Several of the findings addressing this research question signify inconsistent and possibly unreliable use of data to make formative instructional decisions. The data also reveal that progress monitoring within an RTI system may not be serving the purposes for which it was intended.

CBM is being used at regular intervals for screening and benchmark progress monitoring of all students within Tier 1. Most teachers reported the use of CBM at least 2-4 times per year to monitor student progress class-wide, which aligns with research-based recommendations for measurement frequency within Tier 1 (Fuchs et al. 1989b; Johnson et al., 2006). The data do suggest, however, that while most teachers are collecting data of some type, there is a lack of uniformity in teachers' classroom-level DBDIM practices at both Tier 1 and Tier 2. Not only do K-3 general education teachers' measurement and evaluation practices vary greatly, teachers rely more often on informal and unsystematic measures of student progress, rather than formative evaluation using CBM to make instructional decisions within Tiers 1 and 2 of RTI. Many of the sources teachers reported using were often not curriculum-based measures, and, therefore, not only less reliable and objective than CBM, but also likely less useful to teachers' DBIDM. For instance, most teachers reported that they record anecdotal notes for use during instructional planning, which provide qualitative rather than quantitative descriptions of student performance. In addition, teachers reported wide variation in graphing with only one-fourth of teachers graphing consistently. Teachers reported most often that they feel graphing is not necessary or is too time consuming. Teachers, therefore, are more likely using judgment for making instructional adjustments, which limits their effectiveness in improving students' achievement (Fuchs & Fuchs, 1986).

Another finding that has implications for the way progress monitoring is applied is, although teachers reported using data to determine students' responsiveness to and evaluate the effectiveness of instruction and intervention, slightly less than one-third of teachers reported responding to students' progress monitoring data within Tier 2 by discontinuing/decreasing the intensity of current instruction (i.e., moving back to Tier 1). In fact, fewer teachers at Tier 2 than at Tier 1 reported weekly CBM use and graphing. This does not align with research-based recommendations for frequent progress monitoring at Tier 2 (Johnson et al., 2006; Stecker et al., 2008). This may imply that students are likely not being provided with appropriate instruction that is being adjusted according to their progress within Tier 2, that their performance is not being measured appropriately, or that teachers are not responding to the data collected. Therefore, students may be remaining in Tier 2 for longer than necessary without skills being remediated for a return to Tier 1. Moreover, this may illustrate that teachers are not providing instruction that appropriately remediates students learning difficulties, which may increase referrals for special education services within Tier 3.

The data support that some of the persistent issues surrounding best practices within RTI such as effective data use and decision-making practices and procedures (Fuchs & Vaughn, 2012) still indeed exist. CBM is not being used widely at Tier 1 and is not in alignment with research-based recommendations in Tier 2. The findings related to frequency, measurement tools, and responsiveness to data certainly support suggestions in the literature that there is a need for focus on ongoing progress monitoring and making this a feasible, and routine professional practice within RTI (Fuchs & Vaughn, 2012).

Research Question #2: What are teachers' perceptions of the impact their DBIDM practices have on student learning? In general, teachers reported with relative consistency how their DBIDM practices affected student learning. Results indicated that K-3 general education teachers believe that they have a relatively high level of impact on students' learning outcomes as a result of their DBIDM practices, including frequent progress monitoring. Still, teachers reported they have little effect on reducing students' potential referral for special education and related services. This may be a result of teachers' varied and unsystematic measurement, recording, graphing, and evaluation practices that do not consistently align with research-based recommendations for formative evaluation using CBM (Fuchs & Fuchs, 1986). When teachers do not have data from instructionally relevant assessment measures, students' progress or growth within the curriculum as a result of teachers' instruction is not documented. This lack of information may impede meaningful changes in instruction that increase students' rate of progress. Teachers, therefore, may not be connecting assessment and instruction, even within the systematic structure of RTI.

The perception that DBIDM practices do not influence movement out of Tier 2 has implications for identification and response decisions within Tiers 1 and 2. These decisions, absent a valid foundation of student response data, may include over-identification of students moving into Tier 2 supports, and infrequent decisions to decrease the intensity of instruction moving students back into Tier 1. Again, this may suggest that students are either remaining in Tier 2 or being referred to Tier 3 for special education consideration inappropriately. This is concerning in terms of the effectiveness and perceived purpose of RTI as a framework for preventing and remediating underachievement versus a referral model. Teachers, and other school personnel, need to understand that the purpose of the systematic nature of RTI is designed to improve their instructional practice. This helps to ensure that students' academic difficulties are not due to a lack of appropriate instruction and that student progress is documented at regular intervals (U.S. Department of Education, 2006).

Research Question #3: What are teachers' perceptions of the importance of and their preparation for progress monitoring as a part of DBIDM? K-3 general education teachers reported that direct, frequent progress monitoring is highly important within Tiers 1 and 2. Most teachers suggested that progress monitoring is extremely important to their ability to use data formatively, at the class-wide and individuals levels, to plan and implement effective instruction and interventions. Reported levels of importance of progress monitoring were, however, slightly lower on average at Tier 2 than at Tier 1, which is concerning as this is increasingly important at Tier 2. Similar to findings of Cooke et al. (1991), while most teachers believe collecting objective data frequently is important, teachers most often reported the use of informal, unsystematic measures that are insensitive to growth in their classrooms. Teachers seem to think that they are monitoring student progress in ways that guide their instruction, as reported in this study, by their frequent use of daily observations, a variety of formative assessment strategies, and curriculum-based assessments that accompany instructional programs used in their classrooms and schools. Teachers may perhaps find these assessments more accessible and more closely aligned with their daily instruction than standardized CBM measures. This illustrates that teachers may either be confused about the key indicators of growth and basic skills they should be measuring (Deno, 1992), or not recognize what important skill outcomes to measure, thereby not understanding what both the assessments they are using and CBM truly measure.

Results also indicated that most K-3 general education teachers feel prepared for the steps of progress monitoring outlined in the literature by Stecker et al. (2008). Still, teachers feel their readiness in selecting appropriate progress measures is lower than for other aspects of progress monitoring. In fact, one-third of the teachers reported slight to no preparation, or that this does not apply to their current teaching role. This may be a factor in teachers' largely reported use of informal and unsystematic measures. Because progress monitoring is central to teachers' DBIDM practices, their lack of preparedness in this step might explain practices reported within this study. It may also be that teachers do not feel they have a say in which measures are used to monitor student progress because certain assessments are required within their school and/or district. Many schools that use an RTI or similar MTSS process, determine progress monitoring measures so that school-wide data can be collected. Not having a voice in the measures selected, may contribute to difficulties in connecting data to instruction, but should not affect the degree of preparation. Indeed, one would expect a school-based program would be accompanied by school-wide training.

These findings suggest that professional development related to CBM should include a clear emphasis on progress monitoring as a research-validated method of assessment. Professional development likely needs to address the importance of measuring students' progress on key indicators of basic skills within the curriculum, and reliable and valid measures to obtain this data. Teachers may also require training specifically in the CBM and CBM-like general outcome measures required within the school and district, specifically including how these might be used for more frequent progress monitoring. Trainings should also include supported opportunities to put this learning into practice in their classroom, with feedback. Because, as reported earlier, teachers within Tier 2 seem to value progress monitoring less, and report less weekly progress monitoring and graphing, training and support may need to focus on preparing general education teachers for providing such specialized instruction at this level. Schools and districts may need to examine the assessment systems within implemented RTI models to ensure included measures are (a) time efficient, (b) appropriate for ongoing progress monitoring, and (c) provide teachers with data that is useful to their instruction. This examination might also include making sure that there are appropriate measures available within each school, to allow teachers to select measures based on the documented learning needs of their students.

Research Question #4: What are teachers' perceptions of factors, barriers, and school-based supports for their use of DBIDM practices? Participants reported that they had access to a range of school-based supports for DBIDM practices. More than half of teachers reported the current availability of school-level supports for their DBIDM practices such as (a) staff supports for analyzing and responding to student data at the classroom level (e.g., coaches, interventionists), (b) data review and instructional planning with colleagues (i.e., including grade level teachers, interventionists, special education teachers, and/or other support personnel), and (c) professional development in using student data for classroom level instructional decision-making. In fact, few teachers reported the use of computerized software, which is in contrast to the earlier special education studies, in which computerized CBM data management software was used and technical assistance was provided through training and follow-up supports from research staff (Fuchs et al., 1989a, 1989b, 1990). The training, support, and collaborative data review reported by teachers implies that there is a culture of support for data-use (Jacobs et al. 2009) within schools included in the study, which should lead to teachers' consistent data-use practice. According to the findings of this study, while reported by only a small number of teachers, in some schools where staff supports are available, coaches and interventionists may take the place of rather than support teachers' DBIDM. Teachers may still be left unsure of what to do to help struggling learners in their classrooms. Moreover, when one person is providing instruction and someone else is measuring and evaluating progress, there is greater potential for a disconnect in the DBIDM process, as well as concerns in terms of fidelity.

In spite of feeling generally prepared and supported, some resistance to progress monitoring was found, as teachers cited time as the major barrier to DBIDM at both Tiers 1 and 2. It seems, from teachers' responses, that they feel so much time is spent on assessment that there is little time for instruction. These findings are similar to those of earlier general and special education studies in which teachers felt that district assessments (Kerr et al., 2006) and CBM (Yell et al., 1992) took time away from instruction, and limited their use of various data types (Cooke et al., 1991). As previously discussed, findings from this study demonstrated that the assessments being used most often for frequent progress monitoring are not CBM. Consequently, the assessments being used most frequently may not be easy to administer, appropriate for repeated measurement, or time efficient. These assessments may not provide teachers with the information necessary for their objective decision-making during instructional planning (Deno, 1992).

Teachers have consistently suggested that time is a barrier to their ability to use data formatively in the research literature—a finding repeated here 25 years later (Cooke et al., 1991). Clearly, this data suggests that efforts to address this barrier have not yet affected widespread change in teacher practice or perception. A continued lack of focus on frequent progress monitoring, which includes the use of time-efficient CBM for formative evaluation, may in fact be hindering teachers from effectively connecting assessment and instruction in meaningful ways. Schools should examine school-wide assessment systems to confirm that the types and frequency of measurement expected within each tier of RTI are aligned with research-based recommendations for frequent progress monitoring. In addition, schools should monitor the fidelity of these requirements to be sure measurement is occurring as intended and is feasible for routine practice. It could be that this barrier reflects the numerous demands on teachers' time with so many initiatives for school-reform. It may be, in fact, that teachers' being required to do anything on a regular basis could readily be viewed as taking more time away from their instruction.

Research Question #5: What is the relationship between teachers' reported DBIDM practices within Tier 1 of RTI, and their perceptions of the impact of these practices on student learning, importance of and preparedness for progress monitoring, and school-based supports? Results indicated that there is a statistically significant relationship between K-3 general education teachers' DBIDM practices within Tier 1 and both their preparation for progress monitoring and perceived impact on student learning outcomes. When teachers report being highly prepared for all aspects or steps of progress monitoring, they are more likely to report DBIDM practices that are aligned with research-based practice. Likewise, when teachers feel they are able to highly affect all student outcomes, their DBIDM practices are also more likely to align with best practice. These findings are not surprising, but do provide evidence of the unique contribution these two factors have on teachers' DBIDM practices while controlling for other factors. This illustrates the importance of teachers being highly prepared for *all* aspects of progress monitoring and being able to truly see their affect on *all* student learning outcomes, in order to increase the likelihood of their measurement and evaluation in alignment with recommended best practice (Johnson et al., 2006; Stecker et al., 2008). It is also possible that seeing the effectiveness of good DBIDM practice on student outcomes, serves to maintain teachers' efforts. Focus, therefore, needs to be placed on improving teachers' understanding of the purpose and utility of CBM, as well as practice in connecting assessment and instruction through formative evaluation using CBM.

Limitations of the Study

Some limitations of this study are related to the relatively small sample population, which was restricted to teachers within principal-approved schools in four participating school districts. Consequently, the findings may not reflect the practices and perceptions characteristic of K-3 general education teachers in the remaining schools in these four districts, across other districts in the state, or in other states across the nation.

Other limitations are related to examining only general education teachers' practices and perceptions at both tiers across the same teacher sample. While guidance for RTI implementation suggests that general education teachers are responsible for instruction at each of these tiers, models can vary between schools and districts in terms of who provides instruction and intervention within Tier 2 of RTI (Johnson et al., 2006). For example, reading coaches or instructional assistants may provide Tier 2 interventions. A smaller number of K-3 general education teachers in the sample reported practices and perceptions in the Tier 2 survey section. This small sample size led to the inability to investigate and determine a relationship between practice and perceptions of K-3 general education teachers within Tier 2. As a result, the same relationship between practice and perceptions found in this study, within Tier 1, may or may not be reflected within Tier 2.

In addition, there is the chance that responses from teachers other than K-3 general education teachers were included in the analyzed sample. Best efforts were made to provide the survey link only to general education teachers in grades K-3 by using principal-provided teacher name and email lists. In addition, opt out items were included in the demographics section of the survey as a final checkpoint to filter completed responses. However, only a portion of teachers in the completed sample provided a response to items in the demographics section. Findings, therefore, may reflect practices and perceptions of those other than K-3 general education teachers. Future research may aim not only to include a larger sample size but also to include all of the various individuals that may be a part of a school's RTI team.

Implications for the Field

According to the present study, teachers are using some of the data-use practices discussed by Jacobs et al. (2009), as they seem to be attending to multiple data sources, focusing on student needs, and recognizing the importance of frequent progress monitoring. However, teachers are still working towards the complex stage of changing practice. Accordingly, these findings have implications at the teacher level for training and supported practice to build their knowledge and experience; and at the school level for focusing on frequent progress monitoring and monitoring fidelity within RTI.

The findings of this study suggest a continued need for developing teachers' knowledge and training in both the purpose and utility of CBM (Cooke et al., 1991; Yell et al, 1992). Within teacher preparation programs, formative evaluation using CBM should specifically be a part of learning objectives and evaluation of skills in professional practice within all content-related courses and methodology courses. CBM implementation (administration, scoring, charting, graphing, goal setting, applying data-decision rules, and responding to student data) could be interwoven in existing coursework, or a stand-alone course could be designed to focus on DBIDM across content areas. This focus is important for both general and special education disciplines, and even more so for prospective general education teachers' preparation for their role within RTI. Collaboration between faculties in both disciplines may be key to effectively developing this focus within and across teacher preparation programs.

Professional development provided within schools should be ongoing, and followed by opportunities for teachers to apply what is learned to practice, with support and feedback (Fuchs et al., 1991, 1992; Yell et al., 1992). Staff supports, available across many schools, can be used to support teachers' growth in practice by providing focused trainings, observing teachers' practice with using CBM for progress monitoring, and providing feedback to meet teachers at their current level of development with DBIDM practices (Jacobs et al., 2009). More focused trainings and using school-based staff to provide ongoing, supported experiences with formative evaluation using CBM may not only help to build experience, but also address teachers' concern about time. Teachers need to experience first-hand how connecting assessment and instruction allows them to (a) focus on what needs to be taught; (b) frequently and objectively measure how their instruction is effecting student learning; and (c) determine the instructional features that improve students' learning, while removing the features that do not (Sealander et al., 2012). As teachers begin to implement this systematic measurement and evaluation, they will be better able to determine where students currently are on skills within the curriculum, then provide instruction that meets students' at their current level of performance. By concentrating instructional time on teaching skills that address students' documented learning needs, teachers should find that this not only allows the necessary time to both teach and assess, it increases the efficiency of instruction.

Time, however, has been reported as such a persistent barrier for teachers' connection between assessment and instruction, it is likely that their knowledge and training alone will not simply ensure that all teachers begin using CBM for formative evaluation. Therefore, there are also practical implications of these findings at the school level. In order to address the learning needs of all students across the continuum of supports intended within RTI, findings of this study suggest the need for a focus on the importance of CBM—rather than informal, unsystematic measures—beyond screening and benchmarking (Fuchs & Vaughn, 2012; Hayes & Lillenstein, 2015). A school-wide focus on frequent progress monitoring using CBM may additionally guide teachers' use of assessment measures that are, by design, more time efficient (Deno, 1992). Schools should also develop school-wide schedules and clear expectations for the frequency of measurement that adheres to research-based guidelines specific to each tier. Teachers can, therefore, focus their time on assessing the appropriate students at the appropriate intervals. Expectations may specify, for example, progress being monitored more frequently for a smaller number of students following screening and benchmarking within Tier 1; and students' progress being monitored during and following an intervention within Tier 2.

Also important at the school level, for overall effectiveness of implemented RTI models, is the fidelity of both instruction and assessment (Johnson et al., 2006). Fidelity of implementation should be monitored throughout all tiers and across all individuals involved in the process. Fidelity of progress monitoring will ensure that consistent materials, directions, timing, and scoring are being used (Johnson et. al., 2006; Stecker et al., 2008). In terms of instruction, fidelity measures can confirm that instruction and interventions are not only research-based, but being provided as designed and for the specified amount of time (Fuchs & Fuchs, 2006; Johnson et al., 2006). According to the findings of this study, examining fidelity may be critical in terms of providing appropriate instruction, appropriately monitoring progress, and using the data to make accurate and timely decisions for moving students into and out of Tier 2. Fidelity of implementation at Tier 2 is essential to overall effectiveness of the RTI model because appropriateness of instructional supports and decision-making at this level can potentially dictate a students' return to the general education classroom or identification for special education and related services (Compton, Fuchs, & Fuchs, 2006). By monitoring fidelity, schools can determine if the procedures within RTI are being implemented as intended, feasible for routine practice school-wide, and effective in addressing students' learning needs.

To accomplish each of these practical goals, it may be important to build university-school partnerships, or ongoing statewide partnerships in order to work with districts, schools, and teachers to develop DBIDM protocols that fit the needs of their schools. A protocol can be used by teachers, in conjunction with consultative supports provided by school-based coaches, to guide their DBIDM. This type of partnership might also aid in further research focused on school-wide decision-making processes within implemented RTI models including (a) identifying students as at-risk (i.e., entering Tier 2), and (b) having SLD or making eligibility determinations (i.e., entering Tier 3). In addition, it may be important that further research examines how teachers' time can be maximized by using CBM for DBIDM within Tiers 1 and 2, as well as the effect on student learning outcomes.

Directions for Future Research

RTI models vary from school to school and even district to district, in terms of the composition of the school's RTI team, and the roles team members may play in the DBIDM process. Only half of the general education teachers included in the sample for this study reported providing instruction and interventions at Tier 2, some of whom reported that interventionists or RTI teams are responsible for data use (i.e., collecting, analyzing, and responding to student progress data) at Tier 2. In addition, the findings of this study suggest that decision-making may not be based on appropriate student data, thereby possibly causing students to be not only over-identified for Tier 2, but to remain in Tier 2 for too long. For these reasons, future research may need to focus on practices and perceptions of all individuals who make up the school's RTI or data review team such as administrators, interventionists, coaches, special education teachers, school counselors, psychologists, and other school personnel. It may be important that future research focus on the roles of each of these individuals within the school's RTI model and school-wide DBIDM. This focus can be used to examine (a) who is involved and what their responsibilities are within each tier in regards to instruction, data-use, and facilitating the RTI process; and (b) how these roles might affect general education teachers' classroom level DBIDM practices, as well as student learning outcomes. Related research may also investigate how schools can build a collaborative model amongst these individuals to empower all members in the decision-making process. Building such models may aid schools in developing, monitoring and maintaining an effective RTI model that includes (a) a fluid process of collecting, analyzing, and responding to data of student progress; (b) effective decision-making; and (c) fidelity of assessment and instruction.

There is also a need in the field to build the evidence base for effective DBIDM as part of ongoing progress monitoring within RTI (Fuchs & Vaughn, 2012; Hamilton et al., 2009). Future research should aim to connect clearly the evidence base for formative evaluation using CBM to the effects on student and teacher outcomes within RTI or similar MTSS models. To build this evidence, research should focus on evaluating different implementation models supported by schools or districts to provide schools with definitive suggestions for more effective implementation. Finally, the findings of this study point to more and better teacher preparation in DBIDM practice. Therefore, research must focus on investigating the effectiveness of various types of training, both within teacher preparation programs and schools, in producing improved DBIDM that includes the use of CBM for formative evaluation for frequent progress monitoring.

Summary

In summary, results of this study indicate overall that a gap exists between the research and K-3 general education teachers' DBIDM practices within tiered academic instruction and interventions. Teachers rely more often on informal, unsystematic measures to monitor student progress, which has been noted consistently in the research literature as typical practice and is still demonstrated in these findings 39 years later (Deno & Mirkin, 1977). While instructional decisions may be made based on data, the data is more often measuring mastery within a sequence of skills rather than measuring growth (Deno, 1992), which proves to be both time consuming for teachers and may not provide them with information most useful for instructional planning. This is a concern at all tiers in terms of appropriate instruction, as well as identification of students as at-risk and/or in need of special education services.

Teachers' DBIDM practices reflect their knowledge and experience. Therefore, as indicated in previous research (Cooke et al., 1991; Jacobs et al., 2009; Yell et al., 1992), as well as the findings of the current study, there is a need to further develop teachers' knowledge and experience in connecting assessment and instruction. DBIDM practices within each tier of RTI should include formative evaluation using CBM for screening and benchmarking of all students, and frequent progress monitoring of students identified as potentially at-risk and/or in need of supplemental instruction and interventions. In addition, DBIDM practices should include charting and graphing of students' results on progress measures; and regular review of the data during which standard data-decision rules are applied in order to make instructional decisions (Deno, 1992; Fuchs & Fuchs, 2006; Johnson et al., 2006; Fuchs & Fuchs, 2006). Teachers included in the study sample did not consistently demonstrate these practices being a seamless part of their daily routine at the classroom-level. These findings provide direction for continued efforts in supporting the widespread and sustained use of DBIDM that promotes improved student outcomes and successful RTI implementation.

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APPENDIX A

Research Question/Survey Item Alignment

Research Questions	**Survey Item #(s) and Topic**	**Citation(s)**
RQ 1: How do teachers report using data formatively to make classroom-level instructional decisions for students at Tiers 1 and 2 of their school's Response to Intervention (RTI) model? Focus: Teachers' DBIDM practice (13 items)	6 and 23 Data use: frequency results are used from 3 major school based assessments at T1 and T2	Cooke, Heward, Test, Spooner, & Courson, 1991; Kerr, Marsh, Ikemoto, Darilek, & Barney, 2006;Marsh, Pane, & Hamilton, 2006; Wixson & Valencia, 2011
	7 (open-ended) and 9 Collection: Assessments used and frequency of measurement	Ball & Gettinger, 2009; Cooke et al., 1991; Deno, 1985, 2003; Fuchs & Fuchs, 2006; Foegen, Jiban, & Deno, 2007; Johnson et al., 2006; Kerr et al., 2006; Fuchs et al., 1992; Marsh et al., 2006; Stecker, Lembke et al.,

		2008; Wayman, Wallace, Wiley, Ticha, & Espin; 2007; Wixson & Valencia, 2011; Yell, Deno, & Marston, 1992
	8 and 24 Data use/response: how data is used/for what purpose at T1 and T2	Fuchs & Fuchs, 2006; Hosp & Ardoin, 2008; Jacobs, Gregory, Hoppey, & Yendol-Hoppey, 2009; Kerr et al., 2006; Sealander, Johnson, Lockwood, & Medina, 2012; Stecker, Lembke, & Foegen, 2008
	10 Recording: formats	Cooke et al., 1991
	11 and 12 Graphing: frequency and reasons	Deno & Mirkin, 1977; Cooke et al., 1991; Fuchs & Fuchs, 1986
	13 Data review: frequency of review of data	Fuchs & Fuchs, 2006; Johnson et al., 2006; McMaster et al., 2002; Fuchs et al., 1990, 1991; Stecker et al., 2008

	25, 26, and 27 Data use: steps at Tier 2 for collection, analysis, and response	Deno & Mirkin, 1977; Hayes & Lillenstein, 2015; Hosp & Hosp, 2003; Johnson et al., 2006; Fuchs, Deno, & Mirkin, 1984; Fuchs & Fuchs, 1986; Fuchs & Fuchs, 2006; Fuchs, Fuchs, Bishop, & Hamlett 1992; Fuchs, Fuchs, & Hamlett, 1989a, 1989b, 1991; McMaster et al., 2002; NCII, 2014; NCRTI, 2010; Stecker et al., 2008; Stecker, Lembke et al., 2008
RQ 2: What are teachers' perceptions of the impact their DBIDM practices have on student learning? Focus: Perceived impact on Student Outcomes (1 item)	14 Impact areas for student outcomes	Fuchs & Fuchs, 2006; Hayes & Lillenstein, 2015; Hosp & Ardoin, 2008; Johnson et al., 2006; Fuchs & Fuchs, 1986; NCII, 2014; NCRTI, 2010; Sealander et al., 2012; Stecker et al., 2008; Stecker, Lembke et al., 2008
RQ 3: What are teachers' perceptions of the	3 and 20	Cooke et al., 1991

importance of and their preparation for progress monitoring as a part of DBIDM? Focus: Perceived importance and preparedness for PM (3 items)	Importance of PM for DBIDM	
	16 Preparedness for aspects of PM for DBIDM	Stecker, Lembke et al., 2008
RQ 4: What are teachers' perceptions of factors, barriers, and school-based supports for their use of DBIDM practices? Focus: Perceived factors, barriers, and supports at the school level (11 items)	1 School RTI model: approach	Fuchs & Fuchs, 2006; Johnson, Mellard, Fuchs, & McKnight, 2006; Fuchs & Fuchs, 2006; NCRTI, 2014
	2 School RTI model: decision rules	Fuchs & Fuchs, 2006; Hoover & Love, 2011; Hosp & Hosp, 2003; Johnson et al., 2006; Fuchs, 2003; Fuchs & Fuchs, 1986;

		McMaster, Fuchs, Fuchs, & Compton, 2002; NCRTI, 2010; Stecker, Fuchs, & Fuchs, 2008
	4 and 21 Data use/school-level factor: required frequency of PM at T1 and T2	Fuchs & Fuchs, 2006; Johnson et al., 2006; McMaster et al., 2002; Stecker et al., 2008
	5 and 22 Data use factor: utility of 3 major assessment types at T1 and T2	Kerr et al., 2006; Marsh et al., 2006; Wixson & Valencia, 2011
	15 Data use/school-level supports: Available supports	Ball & Gettinger, 2009; Cooke et al., 1991; Jacobs et al., 2009; Fuchs et al., 1992; Fuchs et al., 1991; Roehrig, Duggar, Moats, Glover, & Mincey, 2008; Vernon-Feagans, Kainz, Amendum, Ginsberg, & Wood, 2012; Yell et al., 1992

	17 and 28 Data use: Barriers at T1 and T2 (open-ended)	Cooke et al., 1991; Jacobs et al., 2009; Kerr et al., 2006; Mandinach, Honey, & Light, 2006; Marsh et al., 2006; Vernon-Feagans et al., 2012; Yell et al., 1992
	18 and 29 Data use: support needs at T1 and T2	Ball & Gettinger, 2009; Cooke et al., 1991; Jacobs et al., 2009; Fuchs et al., 1991, 1992; Roehrig et al., 2008; Vernon-Feagans et al., 2012; Yell et al., 1992
RQ5: What is the relationship between teachers' reported DBIDM practices within Tier 1 of RTI, and their perceptions of the impact of these practices on student learning, importance of and preparedness for progress monitoring, and school-based supports? Focus: Impact of data-use factors on	9 2 variables: CBM (paper/pencil and computer format); Frequency: 2-4 times per year or more frequently	(same as above)
	8 3 variables: Targeting Skills,	(same as above)

DBIDM practices at Tier 1 (Existing variables from 7 items used to create logistic regression model)	Evaluating Effectiveness, Adjusting Instruction	
	3 All variables: Importance of PM for class decisions, Importance of PM for individual decisions	(same as above)
	16 All variables: Selecting PM measures, Administering PM measures, Determining needs from PM data, Selecting interventions, Implementing interventions, Evaluating the effectiveness	(same as above)
	14 All variables: Mastery of skills,	(same as above)

	Maintenance of mastered skills, Meeting needs, Improving achievement, Improving engagement, Improving motivation, Knowledge of goals/progress, Reducing referrals	
	2 All variables: Identification rules, Instructional adjustment rules, Movement between tiers rules, SLD identification rules	(same as above)
	1 Only variable: RTI approach	(same as above)

APPENDIX B

Questionnaire Items for Web-Based Survey

Introduction

Study Title: Classroom Teachers' Formative Data Use for Instructional Decision-Making Within Tiered Academic Interventions

Dear Teachers,

My name is Michelle Murphy and I am a Doctoral Student in the Educational Studies Department at the University of South Carolina. I am conducting this survey to investigate data-based instructional decision-making (DBIDM) practices at the classroom level among teachers in elementary schools implementing a Response to Intervention (RTI) model to address students' academic needs.

I am interested in learning more about how you use data in your classroom to inform both class wide and individual instructional decisions at Tiers 1 and 2 within your school's RTI model. The information you provide for this survey will be used to describe: a) how teachers report collecting and using data formatively to provide effective tiered academic instruction and interventions (i.e., DBIDM); and b) teachers' perceptions of their DBIDM practices in terms of experience, knowledge, training, support and effect on student learning outcomes. By participating, you will have the opportunity to reflect on your data use practices as well as share your thoughts and ideas. Your contribution can aid in developing an understanding of teachers' data use practices and inform future research and efforts aimed at providing ongoing support for such practices. Your participation in this survey will be confidential and is voluntary.

The survey should take 15 minutes to complete. The 30-item questionnaire is made up of three sections and includes Likert-type (e.g., strongly disagree to strongly agree), close-ended, and open-ended items related to data collection and use. The first section includes two items specific to your school's RTI model. The second section includes 16 items specific to DBIDM practices at Tier 1. The third section includes 11 items specific to Tier 2 (There is an opt out question in the event you do not also provide Tier 2 instruction). One final item provides space for sharing any additional information related to data collection and use at either/both tier(s). Please provide a response for each item.

As you complete the survey, you will be asked to provide some demographic information that will allow me to organize and group responses, based on these variables, so that I can describe any patterns. General summaries of the overall findings will be reported to districts after the study is completed, making it important that I know how many teachers are responding from each school/district. This information, as with all survey responses, will remain confidential. Please provide a response for each item.

Thank you in advance for your willingness to participate in this study.

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By selecting "Next" below, you are providing your consent to participate in the study.

Questionnaire – RTI Model Section

This section of the survey pertains to your school's RTI model.

1. Which of the following best describes the approach used within your school's RTI model?
(Multiple Choice/1 answer)
Standard Treatment Protocol (i.e., interventions and instructional programs are prescribed for Tier 2 by the school or district - all students receive the same intervention or curriculum)
Problem Solving (i.e., instruction and interventions tailored individually to meet students' targeted needs - teachers select intervention from a range of options)
Hybrid – a combination of Standard Treatment Protocol and Problem Solving
Don't know
Other (please specify)

2. Which of the following best describes the standard data decision rules used within your school's RTI model?
(Matrix of Choices/1 answer per row: No standard rules, Level (cut score/benchmark), Gap Analysis (size of discrepancy), Growth (rate of progress/slope), Level and Growth (dual discrepancy), Don't Know)

a. Identifying "at-risk" students

b. Making adjustments to instruction/intervention

c. Determining movement between tiers

d. Identifying students with Specific Learning Disabilities/Making eligibility decisions

<u>Questionnaire – Tier 1 Section</u>

This section of the survey pertains to practices within Tier 1 of RTI.

3. How important is direct, frequent assessment and monitoring of student progress to your classroom instructional decision-making (i.e., using data from assessments to plan effective instruction for all learners)?
(Rating Scale: Not at all important, Slightly important, Moderately important, Extremely important)

a. Class-wide instructional decisions at Tier 1

b. Individual instructional decisions at Tier 1

4. How often are you REQUIRED as part of your school's RTI model to assess student performance/progress within Tier 1?
(Matrix of Choices/1 answer per row: Never, Annually, 2-4 times a year, Monthly, Bi-weekly, Weekly, 2-3 times a week, Daily, Don't know)

a. All students in your classroom

b. Students identified as potentially "at-risk" through universal screening

5. How much do you agree with the following within Tier 1?
(Rating Scale: Strongly Disagree, Disagree, Agree, Strongly Agree)

a. Data from annual state assessments are useful in my daily instructional planning.

b. Data from district benchmark assessments are useful in my daily instructional planning.

c. Data from frequent progress monitoring are useful in my daily instructional planning.

6. How often do you use the results from each of the following assessments in your classroom to plan effective instruction for all students within Tier 1?
(Matrix of Choices/1 answer per row: Never, Sometimes, Often, Almost Always)

a. I use data from annual state assessments in my daily instructional planning.

b. I use data from district benchmark assessments in my daily instructional planning.

c. I use data from frequent progress monitoring in my daily instructional planning.

7. What formative assessments do you use in your classroom to inform your daily instructional planning within Tier 1? List assessments below, being sure to include specific names when possible.
(COMMENT/ESSAY BOX FOR RESPONSE)

8. In what ways do you use data from assessments of student performance to plan effective instruction within Tier 1? (MARK ALL THAT APPLY)
(Multiple Choice/Multiple Answers)

Selecting appropriate curricula
Differentiating instruction
Identifying instructional groups (e.g., flexible student grouping by skill needs)
Focusing instruction on targeted skill areas/objectives of demonstrated need
Promoting maintenance of mastered skills
Providing students with feedback on progress/reinforcement for academic behaviors
Evaluating the effectiveness of my instruction
Adjusting instructional practices (e.g., maintain elements that are effective, remove those that are not)
Other (please specify):______________

9. For each type of assessment below (a-j), provide a response pertaining to how often you typically administer the measure to monitor student progress within Tier 1. If you do not use the assessment to monitor student progress, select Never.

(Matrix of Choices/1 answer per row: Never, Annually, 2-4 times a year, Monthly, Bi-weekly, Weekly, 2-3 times a week, Daily)

a. Teacher-made tests
b. Tests from adopted textbooks
c. Written classwork assignments
d. Homework assignments
e. Class projects
f. Observation
g. Curriculum-based measures (paper/pencil)
h. Curriculum-based measures (computerized)
i. Benchmark test
j. Annual State Assessment
Other (please specify other types of assessments you use and how often):________

10. How do you record data from the assessment of student progress for use during your instructional planning? (MARK ALL THAT APPLY)
(Multiple Choice/Multiple Answer)

Letter grades
Number grades
Anecdotal notes
Percent correct
Percent completed
Raw score
Data is recorded using computerized software
Other (please specify)

11. How often do you graph student performance/progress?
(Multiple Choice/1 answer – 1 column)

Never
Occasionally, when I remember
Sometimes, when I am required to or prior to a team/parent meeting
Consistently, following each measure/assessment and scoring
Computerized data software automatically graphs each measure/assessment when completed

12. If you do not always graph student progress, please indicate the reason(s) you opt not to graph data from the assessment measures. (MARK ALL THAT APPLY)
(Multiple Choice/Multiple Answers)

It is not necessary to graph student progress
Graphing is too time consuming
Graphed results are too difficult to interpret
I am unsure of how to graph student progress
Other (please specify):___________

13. How often do you review student progress data for your instructional planning?
(Matrix of Choices/1 answer per row: Never, Annually, 2-4 times a year, Monthly, Bi-weekly, Weekly, 2-3 times a week, Daily)

a. On your own

b. With colleagues (e.g., grade-level, data team, curriculum specialists, special educators)

14. What impact does your use of frequent assessment and monitoring of student progress have on student outcomes?
(Rating Scale: No impact, Slight impact, Moderate impact, Extreme impact)

a. Students' mastery of targeted skills in reading and math

b. Students' maintenance of mastered skills in reading and math

c. Students' academic needs being met through differentiated instruction/targeted interventions

d. Students' improved achievement in overall reading and math

e. Students' engagement in instruction/interventions

f. Students' motivation towards academic tasks

g. Students' knowledge of their goals and progress towards meeting them

h. Reduction in students' potential referral to/identification as needing special education and related services

Other (please specify):

15. Which of the following describes school-level supports that are currently available to you? (MARK ALL THAT APPLY)
(Multiple Choice/Multiple Answers)

Professional development in using student data for classroom-level instructional decision-making
Staff supports for analyzing and responding to student data at the classroom level (e.g., coaches, interventionists)
Computerized supports (data software without instructional recommendations)
Computerized supports (data software WITH instructional recommendations)
Access to materials for collecting, analyzing, and responding to student data
Data review and instructional planning with grade level teachers, interventionists, special education teachers, and/or other support personnel
Administrative leadership, including organized supports and expectations for school-wide data use
Other (please specify):___________________

16. How prepared are you for each of the following aspects of progress monitoring?
(Rating Scale: Does not apply to my current role/teaching position, Not prepared, Slightly prepared, Moderately prepared, Extremely prepared)

a. Selecting appropriate progress-monitoring measures
b. Administering appropriate progress-monitoring measures
c. Determining academic needs based on data of student performance
d. Selecting interventions and instructional strategies to address academic needs
e. Implementing interventions and instructional strategies to address academic needs
f. Evaluating the effectiveness of instruction and interventions

17. Describe the most significant barrier (if any) that prevents you from using student progress data formatively to plan effective instruction for all students within Tier 1.
(COMMENT/ESSAY BOX FOR RESPONSE)

18. Please share your most important suggestion (if any) for supporting your ability to use data formatively to plan effective instruction within Tier 1.
(COMMENT/ESSAY BOX FOR RESPONSE)

Questionnaire – Tier 2 Section

Please answer this item to direct your completion of the remaining survey items.

19. In which content area(s) do you provide Tier 2 academic interventions?
(Multiple Choice/1 answer; Skip Logic to Tier 2 section as item 18 or [if first choice selected, opt out of section 2] to final survey question as item 18)

I do not provide Tier 2 academic interventions
Reading
Math
Both Reading and Math
Other (please specify):______________

This section of the survey pertains to practices within Tier 2 of RTI.

20. How important is direct, frequent assessment and monitoring of student progress to your individual instructional decision-making (i.e., using data from assessments to plan effective supplemental instruction/interventions for learners) within Tier 2?
(Rating Scale: Not at all important, Slightly important, Moderately important, Extremely important)

21. How often are you REQUIRED as part of your school's RTI model to assess and review student performance/progress within Tier 2?
(Matrix of Choices/1 answer per row: Never, Annually, 2-4 times a year, Monthly, Bi-weekly, Weekly, 2-3 times a week, Daily, Don't know)

a. Assess student performance/progress

b. Review progress monitoring data

22. How much do you agree with the following within Tier 2?
(Rating Scale: Strongly Disagree, Disagree, Agree, Strongly Agree)

a. Data from annual state assessments are useful in my planning of Tier 2 interventions and instruction.

b. Data from district benchmark assessments are useful in my planning of Tier 2 interventions and instruction.

c. Data from frequent progress monitoring are useful in my planning of Tier 2 interventions and instruction.

23. How often do you use the results from each of the following assessments in your classroom to plan effective supplemental instruction/interventions for students within Tier 2?
(Matrix of Choices/1 answer per row: Never, Sometimes, Often, Almost Always)

a. I use data from annual state assessments in my planning of Tier 2 interventions and instruction.

b. I use data from district benchmark assessments in my planning of Tier 2 interventions and instruction.

c. I use data from frequent progress monitoring in my planning of Tier 2 interventions and instruction.

24. In what ways do you use data from assessments of student performance/progress to plan effective Tier 2 interventions and instruction? (MARK ALL THAT APPLY)
(Multiple Choice/Multiple Answers)

Selecting appropriate progress monitoring measures
Determining students' academic needs
Identifying instructional groups (e.g., flexible student grouping by skill needs)
Selecting interventions and instructional strategies to meet students' needs
Determining students' responsiveness to interventions and instruction
Determining when changes to interventions and instruction are needed
Providing students with feedback on progress/reinforcement for academic behaviors
Evaluating the effectiveness of chosen interventions
Other (please specify):____________

25. Which of the following steps is/are part of your DBIDM practice when measuring student performance/progress within Tier 2? (MARK ALL THAT APPLY)
(Multiple Choice/Multiple Answers)

Administering and scoring CBM measures (by hand)
Using computerized data software to administer and score CBM measures
Measuring progress using CBM frequently (at least once a week)
Use of progress monitoring data to set goals
Use of progress monitoring data to target skills/focus areas
Graphing of student performance after each measurement

Other (please specify):

26. Which of the following steps is/are part of your DBIDM practice when evaluating student performance/progress within Tier 2? (MARK ALL THAT APPLY)
(Multiple Choice/Multiple Answers)

On my own, reviewing graphed student performance/progress monitoring data frequently (at least once a week)
With colleagues, reviewing graphed student performance/progress monitoring data frequently (at least once a week)
Applying standard data decision rules (according to my school's RTI model) to determine the effectiveness of current instruction
Applying standard data decision rules (according to my school's RTI model) to determine when and if adjustments are needed
Using computerized data software that automatically applies standard decision rules
Other (please specify):

27. Which of the following steps is/are part of your DBIDM practice when responding to student performance/progress within Tier 2? (MARK ALL THAT APPLY)
(Multiple Choice/Multiple Answers)

Continuing current instruction
Adjusting instruction by making changes to one feature at a time, e.g. instructional procedures, instructional materials, frequency of instruction, duration of instruction, instructional grouping, targeted content/skills, motivational strategies
Discontinuing current instruction (moving back to less intensive Tier 1)
Increasing the intensity of support after no response to multiple attempts to adjust instruction (moving on to more intensive Tier 3)
Monitoring progress continuously, i.e. before, during, and after any decision/response to continue, adjust, discontinue, or increase supplemental instruction and interventions
Following instructional recommendations provided by staff supports (e.g., coach/interventionist)
Following instructional recommendations provided by computerized support (e.g., data software that includes advice for instruction)

28. Describe the most significant barrier (if any) that prevents you from using student progress data to plan effective interventions and instruction for students in Tier 2.

(COMMENT/ESSAY BOX FOR RESPONSE)

29. Please share your most important suggestion (if any) for supporting your ability to use data formatively to plan effective interventions and instruction within Tier 2.
(COMMENT/ESSAY BOX FOR RESPONSE)

Additional Information (Final Questionnaire Item)

20/30. Please use the space below to share any additional information that you would like to contribute on this topic that wasn't covered in the survey items.
(COMMENT/ESSAY BOX FOR RESPONSE)

Demographic Information

Please provide a response to each item.

1. Which best describes the highest degree you have received?
(Multiple Choice/1 answer)
    Bachelors
    Masters
    Doctorate
    Other (please specify):___________

2. Which best describes your area of certification/licensure?
(Multiple Choice/1 answer)
    I am not certified/licensed.
    General Education
    Special Education
    Dual Licensure – General and Special Education
    Reading Curriculum Specialist
    Math Curriculum Specialist
    Other (please specify): _________________

3. Which best describes your method of certification/licensure?
(Multiple Choice/1 answer)
    I am not certified/licensed.
    4-year Undergraduate teacher preparation program
    Graduate/Masters teacher preparation program
    Alternative Certification/Licensure (e.g., PACE, TFA, etc.)
    Other (please specify):_______________

4. Which best describes your current role/teaching position?
(Multiple Choice/1 answer)

General Education Teacher
Special Education Teacher
Reading Interventionist/Specialist
Math Interventionist/Specialist
Other (please specify):_________

5. How long have you been a teacher?
(Multiple Choice/1 answer)

I am a first year teacher (0 years)
1-5 years
6-10 years
11-15 years
16-20 years
21+ years

6. Which grade level do you teach?
(Multiple Choice/1 answer)

K
1
2
3
Other (please specify):__________

7. Specify your district: *(Drop down menu of participating districts; Skip Logic to corresponding list of schools in Q8)*

8. Specify your school within (district name): *(Drop down menu of schools in district)*

APPENDIX C

Contact 1: Initial Contact Email

Subject Line: Teacher Survey Participation Request

Dear [Insert Teacher's Name],

I am writing to ask for your help with a teacher data-use survey. You are part of a sample of general education teachers in elementary schools across your district that are implementing a Response to Intervention (RTI) model to address students' academic needs. The goal of this survey is to investigate data-based instructional decision-making (DBIDM) practices at the classroom level. I am especially interested in understanding: a) how you are collecting and using data to provide effective tiered academic instruction and interventions (i.e., DBIDM); and b) your perceptions of such DBIDM practices in relation to your experience, knowledge, training, support, and the effect on student learning outcomes.

The questionnaire is short, only 30-items, and should take no more than 15 minutes to complete. To begin the survey, simply click on the link below:
https://www.surveymonkey.com/r/FQMRCNG

This survey is confidential. Your participation is voluntary, and there is no penalty for not participating. Your district has approved, but is neither sponsoring nor conducting this study. The results of this study will be presented as my dissertation in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Special Education at the University of South Carolina.

I will be happy to answer any questions you have about the study, and can be contacted at (919) 915-1696 or by email (murphy62@email.sc.edu).

Thank you for your consideration, and I truly appreciate you helping me with this survey.

With kind regards,

Michelle

Michelle Murphy, MAEd., NBCT
140 Wardlaw Building
College of Education
University of South Carolina
Columbia, SC 29208
(919) 915-1696
murphy62@email.sc.edu

Faculty Advisor: Kathleen J. Marshall, Ph.D.
kathleen@mailbox.sc.edu

APPENDIX D

Contact 2: Reminder 1 Email

Subject Line: Share Your Ideas - Teacher Survey Participation Request

Dear [Insert Teacher's Name],

On Tuesday, I sent an email to you asking for your participation on a brief teacher data-use survey. I am hopeful that you will take this opportunity to reflect on your data-use practices. I look forward to including your thoughts and ideas in my understanding of data-use for instructional decisions at the classroom level.

The survey is available at: https://www.surveymonkey.com/r/FQMRCNG

If you haven't already done so, please consider taking 15 minutes or less to follow the survey link above. The first page will provide you with more details about the survey study. At the bottom of the page, there is a statement asking for your participation. If you agree, click the "Next" button to begin the questionnaire.

Thank you to those that have already responded! I am unable to see who has completed the survey, because all responses are recorded anonymously. If you have already completed the survey, please disregard this reminder.

If you have any questions, please contact me at (919) 915-1696 or by email (murphy62@email.sc.edu).

Thank you once again for your consideration and helping me with this survey.

Sincerely,

Michelle

Michelle Murphy, MAEd., NBCT
140 Wardlaw Building

College of Education
University of South Carolina
Columbia, SC 29208
(919) 915-1696
murphy62@email.sc.edu

Faculty Advisor: Kathleen J. Marshall, Ph.D.
kathleen@mailbox.sc.edu

APPENDIX E

Contact 3: Reminder 2 Email

Subject Line: How Do You Use Data? - Teacher Survey Participation Request

Dear [Insert Teacher's Name],

Last week, I sent you an email asking that you complete a survey about your data-use practices in the classroom. If you have already done so, thank you very much. I truly appreciate your input and help! I am unable to see who has completed the survey because all responses are recorded anonymously. So, if you have completed the survey, please disregard this reminder.

If you have not yet answered the questionnaire, I encourage you to do so. It should take 15 minutes or less. Simply click on the link below, and then click the "Next" button if you agree to participate and begin answering the survey items.

Link: https://www.surveymonkey.com/r/FQMRCNG

The information you share through this survey is not only important as part of my dissertation, but also to informing and providing direction for future efforts that encourage data-based instructional decision making (DBIDM) in the classroom including within schools, districts, the state, and teacher education programs. It will also provide further direction for my future research related to making DBIDM a seamless part of planning daily instruction that meets students' diverse academic needs. If you have any questions, please contact me at (919) 915-1696 or by email (murphy62@email.sc.edu).

Thank you for your time and consideration.

Many thanks,

Michelle

Michelle Murphy, MAEd., NBCT

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APPENDIX F

Contact 4: Final Reminder Email

Subject Line: Last Chance to Share Your Ideas on Data-Use - Teacher Survey Participation Request

Dear [Insert Teacher's Name],

I recently contacted you asking for your help with a teacher data-use survey. I am writing one final time because I want to be sure that your thoughts and ideas are included in my description of how teachers report collecting and using data to provide effective tiered academic instruction and interventions (i.e., DBIDM); and perceptions of such DBIDM practices in relation to experience, knowledge, training, support, and effects on student learning outcomes. My understanding and accurately describing these practices and perceptions is dependent upon hearing from as many K-3 general education teachers as possible. I need your help to ensure my results are as detailed as possible. If you have already completed the survey, thank you!

To complete the survey, click on the link below and click the "Next" button to begin answering the questionnaire:
https://www.surveymonkey.com/r/FQMRCNG

Responses to the survey are confidential and your participation is voluntary. Data collection for this survey is drawing to a close, and the survey will no longer be available after Tuesday, November 24th, 2015. If you have any questions about the survey or study, please contact me at (919) 915-1696 or by email (murphy62@email.sc.edu).

Thank you for your time, and best wishes for an enjoyable Thanksgiving Holiday to come!

Sincerely,

Michelle

Michelle Murphy, MAEd., NBCT
140 Wardlaw Building
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APPENDIX G

Tables to Accompany Chapter 3

Table G.1

List of Variables Analyzed in Research Question 1

Survey Item	Variable(s)	Values (Type)	Value Descriptions
Q9	teachertest	1-8	1 = never
	texttest	(Frequency)	2 = annually
	classwork		3 = 2-4 times a year
	homework		4 = monthly
	project		5 = bi-weekly
	observation		6 = weekly
	cbm_pp		7 = 2-3 times a week
	cbm_c		8 = daily
	benchmark		
	statetest		
Q10	lettergr	1 and 0	1 = yes (data use selected)
	numbergr	(Mark all the apply)	0 = no (data use not selected)
	anecdotal		
	percentcorr		
	percentcomp		
	rawscore		
	computer		

Q11	graph_freq	1-5 (Frequency)	1 = never 2 = occasionally, when I remember 3 = sometimes, when I am required to… 4 = consistently, following each measurement… 5 = computerized data software automatically graphs each…
Q12	noneed notime toohard unsure	1 and 0 (Mark all that apply)	1 = yes (data use selected) 0 = no (data use not selected)
Q25	adminscorecbm comptoadminscorecbm weeklycbm usedata_goals usedata_skills graphperf	1 and 0 (Mark all that apply)	1 = yes (data use selected) 0 = no (data use not selected)

Q13	datarev_freqown datarev_freqteam	1-8 (Frequency)	1 never 2 annually 3 2-4 times a year 4 monthly 5 bi-weekly 6 weekly 7 2-3 times a week 8 daily
Q6	useT1_state useT1_district useT1_fpm	1-4 (Likert-type/Frequency)	1 = never 2 = sometimes 3 = often 4 = almost always
Q23	useT2_state useT2_district useT2_fpm	1-4 (Likert-type/Frequency)	1 = never 2 = sometimes 3 = often 4 = almost always
Q8	curricula diffinstr flexgrp targetskill maintskill stfeedback evaleffect	1 and 0 (Mark all that apply)	1 = yes (data use selected) 0 = no (data use not selected)

	adjinstr		
Q24	idpmmeasure	1 and 0	1 = yes (data use selected)
	idacadneed	(Mark all that apply)	0 = no (data use not selected)
	idgroups		
	idinterv		
	idresponse		
	idchangeneed		
	providefb		
	evalinterv		
Q26	revdatagraph_own	1 and 0	1 = yes (data use selected)
	revdatagraph_team	(Mark all that apply)	0 = no (data use not selected)
	applyrules_effectid		
	applyrules_adjustid		
	usecomp_applyrules		
Q27	continstr	1 and 0	1 = yes (data use selected)
	adjinstr_b	(Mark all that apply)	0 = no (data use not selected)
	decintense		
	incintense		
	contpmbda		
	instrrec_staff		
	instrrec_comp		

Table G.2

List of Variables Analyzed in Research Question 2

Survey Item	Variables	Values (Type)	Value Descriptions
Q14	mastery	1-5	1 = no impact
	maintain	(Likert-type)	2 = slight impact
	needsmet		3 = neutral
	achieve		4 = moderate impact
	engage		5 = extreme impact
	motivate		
	goalprog		
	lessrefer		

Table G.3

List of Variables Analyzed in Research Question 3

Survey Item	Variable(s)	Values (Type)	Value Description(s)
Q3	impT1_pmclass impT1_pmindividual	1-4 (Likert-type)	1 = not at all important 2 = slightly important 3 = moderately important 4 = extremely important
Q20	impT2_pm	1-4 (Likert-type)	1 = not at all important 2 = slightly important 3 = moderately important 4 = extremely important
Q16	selectpmmeas adminpmmeas detneedspmdata selectinterpm implementinterpm evalinterpm	0-4 (Likert-type)	0 = does not apply to my role 1 = not prepared 2 = slightly prepared 3 = moderately prepared 4 = extremely prepared

Table G.4

List of Variables Analyzed in Research Question 4

Survey Item	Variable(s)	Value (Type)	Value Descriptions
Q1	rti_approach	0-4	0 = don't know
		(Approach types)	1 = standard treatment protocol
			2 = problem solving
			3 = hybrid
			4 = other
Q2	id_rule	0-5	0 = don't know
	instr_rule	(Rule type)	1 = no rules
	move_rule		2 = level
	SLD_rule		3 = gap analysis
			4 = growth
			5 = level and growth
Q4	reqT1_pmall	0-8	0 = don't know
	reqT1_pmatrisk	(Frequency)	1 = never
			2 = annually
			3 = 2-4 times a year
			4 = monthly
			5 = bi-weekly
			6 = weekly

			7 = 2-3 times a week
			8 = daily
Q21	reqT2_pmassess	0-8	0 = don't know
	reqT2_pmreview	(Frequency)	1 = never
			2 = annually
			3 = 2-4 times a year
			4 = monthly
			5 = bi-weekly
			6 = weekly
			7 = 2-3 times a week
			8 = daily
Q15	pdsupp	1 and 0	1 = yes (data use
	staffsupp	(Mark all that apply)	selected)
	compsupp_norec		0 = no (data use not
	compsupp_instrrec		selected)
	accessmatsupp		
	datarevteamsupp		
	adminleadsupp		
Q5	utilityT1_state	1-4	1 = strongly disagree
	utilityT1_district	(Likert-type/Agreement)	2 = disagree
	utilityT1_fpm		3 = agree
			4 = strongly agree
Q22	utilityT2_state	1-4	1 = strongly disagree

	utilityT2_district	(Likert-type/Agreement)	2 = disagree
	utilityT2_fpm		3 = agree
			4 = strongly agree

Table G.5

List of Variables Analyzed in Research Question 5

Survey Item	Initial Variable(s) Used	Initial Values - with Description	New Variable	New Values - with Description
Q9	cbm_pp cbm_c	1-8; 1 = never 2 = annually 3 = 2-4 times a year 4 = monthly 5 = bi-weekly 6 = weekly 7 = 2-3 times a week 8 = daily	T1measure	1 and 0; If either or both variables = 3, 4, 5, 6, 7, or 8, then T1measure = 1 (yes); If both variables =1 or 2, then T1measure = 0 (no)
Q8	targetskill evaleffect adjinstr	1 and 0 1 = yes (data use selected) 0 = no (data use not selected)	T1datause	1 and 0 If all variables = 1, then T1datause = 1 (yes); If one or more of the variables = 0,

				then T1datause = 0 (no)
Outcome/Dependent Variable (DV)				
Created variables from Q8 and 9	T1measure T1datause	1 and 0 1= yes 0 = no	T1dbidm	1 and 0 If both T1measure and T1datause = 1, then T1dbidm = 1 (yes); If either T1measure or T1datause = 0, then T1dbidm = 1 (yes)
Predictor/Independent Variables (IV)				
Q3	impT1_pmclass impT1_pmindividual	1-4 1 = not at all important 2 = slightly important 3 = moderately important 4 =	T1important	1 and 0 If all variables = 4, then T1important = 1 (yes, high importance); If at least one variable = 1, 2, or 3, then T1important = 0

		extremely important		(no, low importance)
Q16	selectpmmeas adminpmmeas detneedspmdata selectinterpm implementinterpm evalinterpm	0-4 0 = does not apply to my role 1 = not prepared 2 = slightly prepared 3 = moderately prepared 4 = extremely prepared	prep	1 and 0 If all variables = 3 or 4, then prep = 1 (yes, high preparation); If at least one of the variables = 0, 1, or 2, then prep = 0 (no, low preparation)
Q14	mastery maintain needsmet achieve engage motivate goalprog	1-5 1 = no impact 2 = slight impact 3 = neutral 4 = moderate	impact	1 and 0 If all variables = 4 or 5, then impact = 1 (yes, high impact); If at least one variable = 1, 2, or

	lessrefer	impact 5 = extreme impact		3, then impact = 0 (no, low impact)
Covariate/Control Variables				
Q2	(sum of: id_rule, instr_rule, move_rule, SLD_rule)	0-5 0 don't know 1 no rules 2 level 3 gap analysis 4 growth 5 level and growth	data_rules	sums of 0-20
Q1	rti_approach	0-4 0 = don't know 1 = standard treatment protocol 2 = problem solving 3 = hybrid	N/A	N/A

4 = other

APPENDIX H

Tables to Accompany Chapter 4

Table H.1

Demographic Information for Participating K-3 General Education Teachers

Characteristic	Frequency (*f*)	Percentage (%)
Highest Degree Earned		
Bachelors/Bachelors+	48	34.04
Masters/Masters+	87	61.70
Doctorate	2	1.42
Other	4	2.84
Area of Certification/Licensure		
Not certified/licensed	1	0.71
General Education	130	92.20
Dual Certification/Licensure	4	2.84
Reading Curriculum Specialist	3	2.13
Other	3	2.13
Method of Certification *		
4-year Undergraduate teacher preparation program	60	42.86
Graduate/Masters teacher preparation program	76	54.29
Alternative Certification/Licensure	4	2.86
Years of Teaching Experience		
0 (first year)	7	4.96
1-5	24	17.02

6-10	31	21.99
11-15	21	14.89
16-20	26	18.44
21+	32	22.70
Grade Level Taught		
K	43	30.50
1	35	24.82
2	37	26.24
3	24	17.02
K-3 Combination	2	1.42
District [a]		
A	14	10.00
B	47	33.57
C	17	12.14
D	62	44.29

Note. n=141.
[a] n=140.

Table H.2

Frequency of Administering Various Assessments at Tier 1

Assessment Name	Never *f* (%)	Annually *f* (%)	2-4 x per year *f* (%)	Monthly *f* (%)	Bi-weekly *f* (%)	1 x per Week *f* (%)	2-3 x per week *f* (%)	Daily *f* (%)
Teacher-Made Tests [c]	24 (14.91)	2 (1.24)	18 (11.18)	20 (12.42)	18 (11.18)	63 (39.13)	14 (8.70)	2 (1.24)
Textbook Tests	54 (34.18)	2 (1.27)	17 (10.76)	26 (16.46)	21 (13.29)	34 (21.52)	4 (2.53)	0 (0.00)
Classwork [d]	6 (3.70)	1 (0.62)	0 (0.00)	13 (8.02)	7 (4.32)	51 (31.48)	32 (19.75)	52 (32.10)
Homework [a]	55 (34.59)	1 (0.63)	0 (0.00)	5 (3.14)	2 (1.26)	42 (26.42)	15 (9.43)	39 (24.53)

Projects [a]	33	7	38	52	8	14	4	3
	(20.75)	(4.40)	(23.90)	(32.70)	(5.03)	(8.81)	(2.52)	(1.89)
Observations	0	2	0	1	1	13	12	129
	(0.00)	(1.27)	(0.00)	(0.63)	(0.63)	(8.23)	(7.59)	(81.65)
CBM	10	3	17	27	19	45	22	17
paper/pencil [b]	(6.25)	(1.88)	(10.63)	(16.88)	(11.88)	(28.13)	(13.75)	(10.63)
CBM computerized [b]	20	9	65	16	10	19	12	9
	(12.50)	(5.63)	(40.63)	(10.00)	(6.25)	(11.88)	(7.50)	(5.63)
Benchmark Tests [d]	6	4	104	38	4	4	1	1
	(3.70)	(2.47)	(64.20)	(23.46)	(2.47)	(2.47)	(0.62)	(0.62)
Annual State Tests [c]	41	49	64	3	1	1	1	1
	(25.47)	(30.43)	(39.75)	(1.86)	(0.62)	(0.62)	(0.62)	(0.62)

Note. n = 158.
[a] n = 159. [b] n = 160. [c] n = 161. [d] n = 162.

Table H.3

Open-Ended Responses for Frequency of Administering Various Assessments at Tier 1

Assessment Type/Name	Frequency of Reported Use	*f*	%
Measures of Academic Progress (MAP)	2 – 4 times per year	3	23.07
Dominie (Reading)	2 – 4 times per year	1	7.69
	Monthly (4-6 weeks)	1	7.69
Progress Monitoring	Monthly	2	15.38
Running Records	Weekly	2	15.38
Beacon Assessments		1	7.69
Online – Moby Max and Khan Academy		1	7.69
Grade level assessments across curriculum		1	7.69
Ipad tasks		1	7.69

Note. n = 13.

Table H.4

Open-Ended Responses for Formative Assessments Used for Instructional Planning at Tier 1

Formative Assessment Type/Name	*f*	%
Formative Assessment Strategies	115	27.12
Observation	24	
Anecdotal Notes/Checklists	17	
Exit Slips	14	
Conference/Oral interview	10	
Running Records	11	
Dry-erase/Whiteboard checks	9	
Question and Answer/Cold calls/Bloom's Taxonomy	7	
Response Logs/Journal Entries/Quick Writes	5	
Graphic Organizers/Thinking Maps	3	
Self-assessment	2	
Think, Pair, Share/Partner Share	2	
Fist to Five/Hold up Fingers to Show Your Understanding of Learning Objective	2	
Informal Assessments	2	
Stand up, Sit down/Thumbs up, Thumbs down	2	
Post it, Check it, Cheer it (Marzano)	1	
Four Corners	1	
Task Cards	1	

Rotation Sheets	1	
Checkpoints	1	
Classroom-based Assessments and Activities	76	17.92
Quizzes and Tests	15	
Teacher-made Tests	14	
Writing prompts/Rubrics (x 2 based on Lucy Calkins)	7	
Textbook Tests (Chapter/Unit)	7	
MyMath (McGraw-Hill) Check My Progress	5	
Classwork	5	
Student work samples/Interactive Data Notebooks	5	
Workbook/Worksheet/"Think" sheets	3	
Homework	2	
Center Time/Small group	2	
Leveled Passages/Cold Reads	2	
Read Works (Leveled Passage and Question Sets)	1	
Projects	1	
Authentic Classroom Assessments	1	
Guided Reading	1	
Buddy/Independent Reading	1	
Word Lists	1	
Math Facts/Timed Fact Test	1	
Phonics	1	
SmartBoard Activities	1	

Screening, Benchmark, and Formative Progress Monitoring Tools	70	16.51
Dynamic Indicators of Early Literacy Skills (DIBELS)/Dibels Oral Reading Fluency (DORF; Reading)	37	
Dominie Reading Assessment (Reading *state required in Reading First schools)	16	
AIMSweb (Reading and Math)	7	
EasyCBM (Reading and Math)	4	
CCSS Assessment Suite (Success Checks/Quick Checks; Reading and Math)	3	
Letter/Sound Knowledge	2	
Amplify/Beacon Assessments (mCLASS; Reading and Math)	1	
Benchmark Assessments	69	16.27
Measures of Academic Progress (MAP; Reading and Math)	27	
District Benchmark Assessments	27	
Fountas and Pinnell Benchmark Assessments (Reading)	14	
Benchmark Assessments	1	
Curricula/Instructional Programs	37	8.73
Imagine It! (Reading)	17	
Everyday Math/EM Homelinks (Math)	7	
Words Their Way (Word Study/Spelling)	4	
Wilson Fundations (Reading)	2	
SRA (Reading)	2	
Montessori Works/Curriculum	2	

ReadWell (Reading)	1	
Primary Units of Study (Writing)	1	
Language and Literacy Intervention (LLI)	1	
Screening/Diagnostic (Pre-Post Assessments	24	5.66
DRA/DRA2 (Reading *state required in Kindergarten)	22	
My Individual Growth and Development Indicators (IGDIs, *state required in Kindergarten)	1	
CORE Phonics (Reading)	1	
General Content/Curriculum Assessments	16	3.77
Content/Curriculum Skills Assessments (weekly or bi-weekly)	12	
Grade-Level Common Assessments	3	
Data from School-wide Assessments	1	
Online Skill-Based Practice	7	1.65
Games/ Apps (skill-based)	4	
First in Math	2	
Study Island	1	
Computer Assisted Instruction with Measurement	5	1.18
Reading A-Z/RAZ Kids (leveled reading)	2	
E-Spark (ipad Curriculum, pre-post quizzes by standard)	2	
Imagine Learning (Reading software, Lexile growth measures)	1	
Aptitude/Achievement Tests	3	0.71
Cognitive Ability Testing (CogAT; *state required in Grade 2)	2	
Iowa Assessments (IA; *state required in Grade 2)	1	

Teacher Evaluation/Student Growth Measure	1	0.24
Student Learning Objectives (SLOs)	1	
Other (unclear)		
Dialed and Benchmarks	1	0.24

Note. n = 424.

Table H.5

Open-Ended Responses for Reasons for Not Always Graphing at Tier 1

Reason for Not Always Graphing • Descriptive Response(s)	*f*	%
Alternatives to Graphing	6	19.53
• Students keep DATA notebooks. During conferences, we graph Dominie scores, Spelling/Sentence dictation scores (phonemes and words correct), and we also use Glow and Grow sheets to track student progress in reading and math. Students also track writing growth using the writing rubrics for Lucy Calkins.		
• I use other ways to score and record assessments and to group my students.		
• I use charts and tables to track data, I just don't put it in a graph.		
• I feel I can explain grades better to parents by showing them each grade separately.		
• I keep a portfolio of student work to show parents of progress or the team.		
• I prefer to keep each student's data on separate sheets and look at it individually.		
Graphing is Not Necessary	5	16.13
• There is no reason.		

• The graph itself isn't necessary to use the data for instruction.		
• I can see clearly without graphing if skills are going up or down and if reinforcement of skills is needed.		
• While graphing is a useful tool for some teachers, I have never found it helpful.		
• It is not necessary for everything I assess.		
Never Have/Unsure of How to Graph	3	9.67
• Just never have done. First year teaching primary grade.		
• Never thought of graphing progress, only where students currently are.		
• Unaware of the process		
Graphed by Others	3	9.67
• It is done for me.		
• Someone else does it for us.		
• I use graphs provided by EasyCBM and MAP.		
Time Spent Planning Versus Graphing	2	6.45
• It is far more important to spend my time to plan and work with the children than to collect data.		
• I prefer to use my time studying and planning for specific objectives students' needs to learn based on assessments.		

Only Graph Sometimes	2	6.45
• I only use and share graphs when discussing student MAP scores with parents.		
• At our school, we are only graphing the data for students who are having an RTI process completed on them (being tested for a possible learning disability).		
Graphing is Difficult	2	6.45
• I'm a K teacher. Difficult to graph when there are no numeric grades. All my kids get are S, P, & N scores.		
• There are too many different areas that we test to graph each are for each child.		
Graphing is Redundant	2	6.45
• Reports are run from the data and can be easily read. Graphing the data is duplicating what has already been done for us.		
• Some of the data that I receive from the assessment measure is redundant.		
Graphing is Not Necessary and Time Consuming	1	3.23
• I know where my students are, so graphing is not necessary and it's time consuming. If it's not purposeful, I have no need to do this.		
No Time to Graph	1	3.23
• Other than assessments graphed by the computer, I do		

not take time to graph. There is simply no time.		
Materials	1	3.23
• Uses too much ink.		
Additional Comments (no specific reason for not graphing provided)		
• As a district, we look at data and analyze often. It may not be in graph form, but we look at intensive, strategic, and benchmark.	1	3.23
• These results can show discrepancies.	1	3.23
• A visual is extremely helpful.	1	3.23

Note. n = 31.

Table H.6

Frequency of Assessment Required at Tier 1

Required at Tier 1	Don't Know *f* (%)	Never *f* (%)	Annually *f* (%)	2-4 x per Year *f* (%)	Monthly *f* (%)	Bi-Weekly *f* (%)	Weekly *f* (%)	2-3 x per Week *f* (%)	Daily *f* (%)
Assess All Students in Classroom	15 (9.38)	2 (1.25)	3 (1.88)	57 (35.63)	25 (15.63)	15 (9.38)	28 (17.50)	7 (4.38)	8 (5.00)
Assess Students Identified as Potentially At-Risk [a]	13 (8.18)	2 (1.26)	3 (1.89)	16 (10.06)	23 (14.47)	43 (27.04)	32 (20.13)	17 (10.69)	10 (6.29)

Note. n = 160.
[a] n = 159.

Table H.7

Frequency of Assessment and Review Required at Tier 2

Required at Tier 2	Don't Know *f* (%)	Never *f* (%)	Annually *f* (%)	2-4 x per Year *f* (%)	Monthly *f* (%)	Bi-weekly *f* (%)	1 x per Week *f* (%)	2-3 x per Week *f* (%)	Daily *f* (%)
Assess Student Progress	3 (3.75)	1 (1.25)	1 (1.25)	4 (5.00)	16 (20.00)	18 (22.50)	20 (25.00)	8 (10.00)	9 (11.25)
Review Progress Monitoring Data	3 (3.75)	1 (1.25)	2 (2.50)	6 (7.50)	16 (20.00)	19 (23.75)	17 (21.25)	10 (12.50)	6 (7.50)

Note. n = 80.

Table H.8

Open-Ended Responses for Teachers' Suggestions for Supporting Formative Data Use for Instructional Decision-Making at Tier 1

Support Category Sub-category • Descriptive Response(s)	*f*	%
Needs		
Time	22	30.98
• Instructional planning time that give teachers time to analyze AND plan, not just to analyze/need for more planning time during the day/quit taking planning away (x 5)		
• Time (as a single-word response - x 4)		
• Uninterrupted time (x 4)		
• Planning time with the team for vertical meetings to allow for cohesiveness between grades.		
• One extra planning period per week for data analysis!		
• I'd like more time to work on finding/sharing/creating tools, games, etc. to use as interventions.		
• Time to allow [teachers] to use data, plan, and set goals for the students.		
• Time says it all…we work 7 days a week trying to meet the needs of all of our students…there must be a way to have		

someone coordinate our data and make a plan for us to follow.		
• Teachers need time to look through data, discuss with peers and determine the best ways to use that data in the classroom. And not just their personal time. TIME within the school day/year.		
• More time on Professional Learning days to have time to do this rather than sit in meetings.		
• Instructional time MUST be maximized. Administrators need to use care when scheduling additional activities outside of the classroom, and schedules should be studied and looked at carefully to ensure students have the maximum amount of time inside the classroom. Teachers cannot teacher a solid reading, writing, or math lesson, where everyone's needs are met in 30 minutes. Instructional time needs to be protected.		
• Having time to use results from data to effectively plan lessons to target and support the independent needs.		
Knowledge, Training, and Support	13	18.31
• Collaboration with instructional coaches, colleagues, and school psychologists (x 7)		
• Provide guidance and support to all teachers!! Most of us need that support.		

• Help with finding resources to use once you figure out where students need help. • Support from administrators • I feel like the most important suggestion for supporting my ability to use data formatively would be to have someone model data collection and walk through the discussion of what they would do with the data and what for each student. This is time consuming, but a real life experience with my class as a model would be helpful. • Allow teachers to observe pull out groups. • Proper professional development for literacy coaches, Response to Intervention Team and staff		
Materials/Resources	4	5.63
• We need materials • Providing already ready tools and resources for teachers and students • If/Then continuum for reading/writing/math; I already use one for writing and it helps so much to use as a tool to know where to take your kids next. • I would like a set curriculum or assessment to use to progress monitor Tier 1 students.		
Class Size	1	1.41
• Class size needs to be manageable for teachers.		

Suggestions/Benefits		
Suggestions from “What Works” in Their Data Use Practice	16	22.54
• Be consistent in pulling students to small group to work on struggling area/keeping a checklist and communicating instructional needs to the curriculum coach or admin.		
• Groups are constantly changing due to progress monitoring results.		
• Use all strategies given to you by your grade level team, your grade level coach, and administration.		
• Learn different strategies and techniques to assess your students because every child learns differently. It is a teacher’s job to continue a child’s education and find the best way an individual child learns.		
• Be adaptable and open to new assessments, or strategies to work with students both formally and informally.		
• Look at the overall picture of each child’s score and set goals for them to move forward to the next grade.		
• I would say, be organized. If my data weren’t organized, it would be more difficult to see it and plan with it.		
• Tier 1 student need to be looked at as a whole student. How they perform in each area, not just one content [area].		
• Analyze it [data] frequently, and keep up with monitoring the students’ progress. Celebrate the success of the student		

even when they are small.

- Daily one-on-one or small group work with Tier 1 students.
- Monitor student progress
- I am constantly in contact with the lead interventionists, math, literacy, and technology coaches to help with planning my instruction for all my students (not just tier 1 students). This has been my best opportunity for planning that I have found to be most productive.
- It is important to look at the data and make sure that we are best meeting the needs of the students, even if it means using different material, other than what is supplied. We need to make sure all students are growing and learning.
- Plan, plan, plan! Be prepared before hand, have all materials you need ready for when you need them, and seek out help and suggestions when you are unsure!
- Make the time and be consistent.
- Use graphs to show trends for the entire class.

Benefits of Their Current Data Use Practice	4	5.63

- Parents see scores on weekly assessments and are more apt to help their child at home.
- Supports the classroom teacher.
- Using data formatively is so very important to the success of all students, not only those in Tier 1. The information you

receive from formative assessments is needed in order to differentiate instruction to meet the needs of all learners in the classroom.		
Preferences/Comments		
Assessment/Instruction Preferences	10	14.09
• Not having to go by the data so much. The test is not always a reflection of what a student is or is not capable of.		
• It would be helpful to consolidate the number of assessments we are required to give to ensure we are getting the important information and have time to use results.		
• Assessments should only be given if you are able to use the data to drive instruction.		
• There need to be more options in Tier 1 to be used to determine student needs. More teacher/student interaction need to be implemented (not just referring teacher but other teachers to interact with the student daily).		
• I wish I had more input and could use classroom assessments (summative and formative) and observations to bring to the table during RTI meetings.		
• I find the most informative data I use is daily observations of a students' understanding of the concepts being taught and whether the student is able to apply the skill/s learned.		
• NO more state wide testing		

- I monitor progress all day long. Sometimes the informal observations are more telling than the longer assessments. My students sit in tables, so they don't have much privacy. I am concerned about them looking at each other's work at times. When we are all working together on whiteboards on the floor, however, they have to think quickly and don't look around as much. Those informal times are integral in seeing what they truly know and what confusions they have.
- In my grade level, one-on-one assessments and daily anecdotal notes are most important in determining the student's progress and growth.
- I miss our school's math intervention program. I'm having a hard time reaching all the students' individual needs for T1, 2, and 3 in math. Our former pull-out program was serving students quickly and intensely, and moving them out of T2 and T3. I need to be more than 1 person or give me students homogeneously grouped to teach! My ELA students in T1 are pulled for small group instruction more often than other students, but areas to work on are changing constantly (much re-teaching, then pulled for reviewing occasionally).

General Comments on Assessment/Instruction	1	1.41

- A good teacher knows their children and should be able to progress monitor in whatever way they think is best for the

	child.

Note. n = 71.

Table H.9

Open-Ended Responses for Teachers' Suggestion for Supporting Formative Data Use for Instructional Decision-Making at Tier 2

Support Category Sub-category • Descriptive Response(s)	*f*	%
Needs		
Time	7	30.43
• Uninterrupted time to plan/time to consult with others during the school day (x 4)		
• Time (as a single-word response – x 3)		
Knowledge, Training, and Support	5	21.74
• Consulting with other grade level professionals (x 3)		
• Suggestions from the Student Assistant Team at my school.		
• Training		
• More staff development to support new teachers in using data.		
• Kids are tested in so many different ways, so as a teacher it is overwhelming to try to figure out what tests to analyze and what results we are supposed to use.		
More Interventionists	1	4.35
• We need more interventionists in our school to meet		

more students' needs		
Suggestions/Benefits		
Suggestions for "What Works" in Their Data Use Practice	4	17.39
• Determine students; needs and then plan specifically for each student. Use coaches and other personnel to help with decisions!		
• Differentiated instruction is extremely important. Addressing any concerns, and pushing students to move forward so they don't get bored. Be open to different strategies, and tests to use to enhavne instruction. Be willing to change, and find a better option if something doesn't work.		
• I would say having the data organized and prepared.		
• Make a list of skills students need to master according to the grade level standard.		
Benefits of Their Current Data Use Practice	1	4.35
• It allows for more focused instruction		
Preferences/Comments		
Assessment/Instruction Preferences	4	17.39
• I would like to see flexible grouping across classrooms. It would be nice to share students and have students do more "walk to read, etc. to maximize our instructional time.		

• Return math intervention program and complete reading intervention to my school or give me students on similar levels in my first grade classroom to teach. • We need to be testing and progress monitoring in a reasonable proportion to the amount of time spent teaching. • Add Tier 2 Math intervention		
General Comments on Assessment/Instruction	1	4.35
• We are over assessing our students, and it is costing a bundle. We need to look at other countries and see what they are doing, such as Denmark…the smartest country in the world, and they do not test their students. We need to get back to the fundamentals. Frequent progress monitoring by classroom teachers is essential so instruction can be enhanced or adjusted to meet the needs of every student.		

Note. n = 23.

Table H.10

Open-Ended Responses for Barriers Preventing Formative Data Use for Instructional Decision-Making at Tier 1

Barrier Category Sub-category • Descriptive Response(s)	*f*	%
Time	62	72.09
• Time (as a single-word response – x 23; also written as TIME, Time! and Time!!)		
• Planning time/Sufficient planning time (x 5)		
• Time during the instructional day/not enough (x 3)		
• Time in the classroom to administer assessments, and outside the classroom to analyze the data.		
• Finding the time to plan, implement, and assess Tier 1 students is difficult.		
• Time to gather all the data and make sense of it so I can plan accordingly.		
• With 27 students, it is hard to individually plan. It is hard when you have taught something and you see students do not understand but you are going to run out of time to teach everything else if you spend more time on the original topic.		
• I teach first grade. I work 10-12 hours every day. Too		

much data collection is not possible by me unless I take time away from teaching the children.

- With the district changing expectations and programs so frequently I don't have enough time to "get my feet wet" and master what they are expecting me to do before there is a change.
- Time to sit down and really review data on top of other responsibilities.
- Not given enough time to review and collaborate with others.
- There is not enough time during the school day! I teach mostly in small groups and there is never enough time to meet each child's needs.
- Time to grade everything and meet with the students one on one or in small group as often as I would like to.
- Time! But I do it anyway.
- Not enough time to do all of this all the time. I informally assess and monitor. I monitor and adjust instruction as needed based on observations and a few formal reading assessments throughout the year.
- Elementary teachers struggle to find the time to teach students everything they need to learn in a grade level.
- The most significant barrier I face in the classroom is

time. Our data is gathered through student interviews and observation so this data has to be analyzed by the teacher. Then instructional decisions can be made.

- Time is always a barrier because it takes time to analyze and find ways to meet each student's needs.
- It is VERY time consuming to review the data and plan appropriately, however, I do it.
- Class time and interruptions.
- Time is the number one barrier for using data to analyze instruction and prepare differentiated materials based on those goals.
- Time. Finding the time to "do it all" is a constant struggle.
- Time – first graders have not built up an attention span for small group work throughout the day.
- The amount of time available within a school day to prepare and plan accordingly.
- Time and amount collected.
- There are no barriers, however it is extremely time consuming and I am a veteran teacher of over 30 years experience.
- We spend a great deal of time giving assessments to the point that we have limited instructional time.

- We are required to give a lot of testing, which has to be done one-on-one in Kindergarten. This takes up a lot of our time that we would have available for more small groups, to help individualize instruction.
- In anything, time is the only barrier that would prevent me from using student progress data to plan instruction. There is so much data to analyze and only so many hours in the day.
- I feel like because we are progress monitoring each week, that is one day a week that could be used for instruction. I feel like we are progress monitoring too much.
- There isn’t a whole lot of time.
- Takes up a lot of time. Spend more time assessing than actually teaching.
- Scheduling time to work with the grade level team.
- Time. There is never adequate time to analyze the data we have.

Students/Parents

Language Barriers 3 3.49

- Language Barrier (x 2)
- The language, they learn in Spanish, so it is very difficult for them.

Gaps in Student Achievement	1	1.16
• The gap between students.		
Student Self-direction	1	1.16
• Often students are not self-directed and expect constant help and scaffolding. Students need to learn to be autonomous using skills they have learned. They need problem solving skills as well as reading and math skills in order to be successful.		
Student Attendance	1	1.16
• Attendance of student		
Support from Home	1	1.16
• Support from home.		
District/School		
Class Size/Number of Interventionists	2	2.33
• Student/teacher ratio		
• We need more interventionists.		
Instructional Program/Curricula	2	2.33
• The curriculum we use does not allow for many days to re-teach material/concepts that need to be reviewed.		
• Pre-determined and specific learning programs for subjects such as phonics, reading and math. It can be frustrating to "have" to teach something when you know your kids already know that material but need more help		

with something else.		
Grading Reports	1	1.16
• Not being allowed to give appropriate grading reports to parents.		
RTI Process	1	1.16
• We are not able to select these students. When we recommend any students, if the MAP percentiles don't match up, they don't get in.		
Training, Knowledge, and Support		
Small Group Instruction/Management	3	3.49
• It's hard to work with a small group and have the rest of the class involved for 5-10 minutes in another activity at this time.		
• Trying to squeeze the various scores into four groups is difficult at times.		
• Too many small group instructions throughout the day prevent specific instruction for the lower students.		
Administrative Support	1	1.16
• Little to no support from top administration.		
Practice and Feedback from Others	1	1.16
• The most significant barrier that prevents me from using data formatively and feel like I am doing it "right" is lack of practice or feedback from others. There are a		

number of different instruments/materials to use for formative assessments, but it can be very overwhelming to choose the "right" tool.		
Standards/Curriculum	1	1.16
• I don't have any particular set of standards or curriculum that is to be used with Tier 1 students for progress monitoring.		
Comments/Preferences		
General Comments on Assessment/Instruction	3	3.49
• I went to college to be an educator, not a data analyst.		
• I feel that these lengthy requirements and all of the evaluation limit the actual instruction time for younger students and I am sure this is driving some of the younger teachers away from our field. They remark that "all we do is test, evaluate and collect data and we don't have time for instruction"…this is discouraging to hear.		
• It is as though referrals are looked down on and if we do our jobs there should not be a need for a referral which is unrealistic.		
Assessment/Instruction Preferences	1	1.16
• Assessments should not be administered so much in Kindergarten. I get more information and better understanding from my individual assessment and		

instruction. The stat is requiring too many assessments and time taken away from instruction. Kindergarten students should not have to be assessed in this way. We need to let our children develop at their own pace.		
Additional Comment - Affirming Data Use and Benefit (no barrier included)	1	1.16
• I use data to drive my instruction. Through observations and one-on-one assessments I monitor students' progress and use it for instruction. Assessing the children is extremely necessary to inform my teaching.		

Note. n = 86.

Table H.11

Open-Ended Responses for Barriers Preventing Formative Data Use for Instructional Decision-Making at Tier 2

Barrier Description	*f*	%
Time	23	63.89
• Time (as a single-word response – x 14; as written as TIME)		
• Teachers need more time to plan/not enough (x 2)		
• Not enough time/time in a day (x 2)		
• Time to work with them individually.		
• Time in the classroom.		
• Time to fully analyze and prepare for using data.		
• There are no barriers, however it is time consuming		
• Again time, one instructional day is missed each week because of weekly progress monitoring.		
District/School Level		
RTI Model/Processes	4	11.11
• We don't get to select students for this intervention. It only depends on their percentile on MAP. They have to be in the 10th percentile or less…so if a child is struggling but happens to accidentally score higher on MAP then they don't get in.		
• We do not have Tier 2 intervention for Math		

• Number of students in the Tier program.		
• Number of students needing T2 small group instruction		
Number of Teachers/Interventionists	2	5.55
• Not enough teachers.		
• If there are too many [students] and we only have 2 teachers which is what our school has then a TON of kids that need tier 1 go into tier 2 which means they still have second grade level curricula which is not appropriate for them and where they are.		
Resources	1	2.78
• Not having the resources to implement the interventions needed for certain students.		
Instructional Programs/Curricula	1	2.78
• Rigorous and structured programs		
Students		
Language Barriers	2	5.55
• Language barriers		
• The language.		
Student Attendance	1	2.78
• Student attendance		
Training/Knowledge	1	2.78
• Knowledge or training		
General Comments on Assessment/Instruction	1	2.78

	• So many tests and "quick" check ups are taking away teaching time…the younger teachers are asking if the tests are driving the instruction or if the tests are all that seem to matter…

Note. n = 36.

Table H.12

Perceived Level of Impact for Frequent Assessment and Progress Monitoring on Student Outcomes

Student Outcome	No Impact *f* (%)	Slight Impact *f* (%)	Neutral *f* (%)	Moderate Impact *f* (%)	Extreme Impact *f* (%)	*Mean*	*SD*
Mastery of Targeted	1	6	13	73	68	4.25	0.80
Skills	(0.62)	(3.73)	(8.07)	(45.34)	(42.24)		
Maintenance of	0	11	19	74	57	4.10	0.86
Mastered Skills	(0.00)	(6.83)	(11.80)	(45.96)	(35.40)		
Academic Needs	2	5	7	74	73	4.31	0.80
Being Met	(1.24)	(3.11)	(4.35)	(45.96)	(45.34)		
Improved	1	7	6	84	63	4.25	0.77
Achievement Overall	(0.62)	(4.35)	(3.73)	(52.17)	(39.13)		
Engagement	3	8	18	83	49	4.04	0.88
	(1.86)	(4.97)	(11.18)	(51.55)	(30.43)		
Motivation[a]	6	11	22	75	46	3.90	1.01
	(3.75)	(6.88)	(13.75)	(46.88)	(28.75)		
Knowledge of	5	8	23	72	51	3.98	0.97
Goals/Progress [b]	(3.14)	(5.03)	(14.47)	(45.28)	(32.08)		
Reduction in	9	15	33	72	31	3.63	1.07
Potential Referral [a]	(5.63)	(9.38)	(20.63)	(45.00)	(19.38)		

Note. n = 161.
[a] n = 160. [b] n = 159.

Table H.13

Perceived Level of Preparation for Aspects of Progress Monitoring

Aspect of Progress Monitoring (PM)	Does Not Apply *f* (%)	Not Prepared *f* (%)	Slightly Prepared *f* (%)	Moderately Prepared *f* (%)	Extremely Prepared *f* (%)	*Mean*	*SD*
Selecting Measures	16 (9.94)	5 (3.11)	22 (13.66)	64 (39.75)	54 (33.54)	2.84	1.21
Administering Measures[a]	6 (3.75)	6 (3.75)	17 (10.63)	62 (38.75)	69 (43.13)	3.14	1.00
Determining Needs	1 (0.62)	1 (0.62)	12 (7.45)	71 (44.10)	76 (47.20)	3.37	0.70
Selecting Strategy/Int	3 (1.86)	2 (1.24)	19 (11.80)	84 (52.17)	53 (32.92)	3.13	0.80
Implementing Strategy/Int	1 (0.62)	1 (0.62)	10 (6.21)	87 (54.04)	62 (38.51)	3.29	0.67
Evaluate. Effectiveness [a]	4 (2.50)	2 (1.25)	16 (10.00)	81 (50.63)	57 (35.63)	3.16	0.84

Note. n = 161. Int = Intervention.
[a] n = 160.

Table H.14

Data for Dichotomous Outcome and Predictor Variables Used in Logistic Regression Model

Variable	% yes	% no
T1measure	96.05	3.95
T1datause	32.24	67.76
T1dbidm	34.21	65.79
T1importance	16.45	83.55
prep	34.87	65.13
impact	46.71	53.29
support	35.53	64.47

Note. n = 152.

Table H.15

Data for Control Variables Used in Logistic Regression Model

Variable and Values	*f*	%	***Mean***	***SD***
data_rules			1.9210	0.9457
0	11	7.24		
4	3	1.97		
5	1	0.66		
6	5	3.29		
7	1	0.66		
8	19	12.50		
9	4	2.63		
10	13	8.55		
11	6	3.95		
12	2	1.32		
13	9	5.92		
14	16	10.53		
15	10	6.58		
16	11	7.24		
17	12	7.89		
18	5	3.29		
19	3	1.97		
20	21	13.32		
rti_approach			12.5000	5.5790

0	6	3.95
1	53	34.87
2	43	28.89
3	47	30.92
4	3	1.97

Note. n = 152.