

Effect of Degree of RTI/MTSS Implementation on
Reading and Mathematics Achievement Growth in a Metropolitan School District

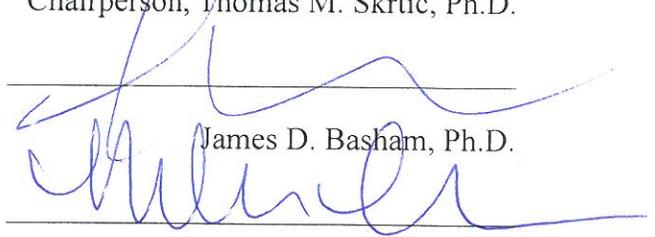
By

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Submitted to the graduate degree program in the Department of Special Education and the Graduate Faculty of the University of Kansas in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

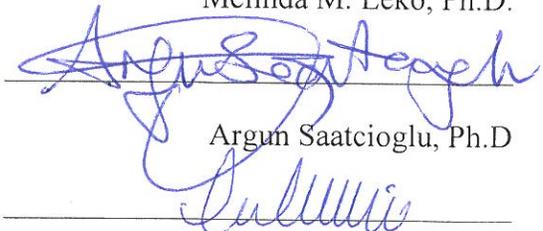


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ABSTRACT

This study examined the growth in mathematics and reading achievement, respectively, of 7,587 and 7,807 first through sixth grade students in a large Midwestern, suburban school district implementing Response to Intervention/Multi-Tier System of Supports (RTI/MTSS) between 2013 and 2014. Reading and mathematics achievement growth was measured with the Measures of Academic Progress (MAP) and RTI/MTSS implementation was measured by the School Implementation Scale (SIS) survey, administered to teachers and administrators. The dependent variable was student growth on the MAP in reading and/or mathematics and the independent variable was level of RTI/MTSS implementation at the grade level and school level. Predictor variables were included for individual level student characteristics (gender, race, socio-economic status, disability, and level of inclusion), classroom level characteristics (teacher education, years of experience, and class percentages of female, racial/ethnic minority, and low SES students, and students with disabilities), and school characteristics (percentage of low SES and racial/ethnic minority students, and students with disabilities). The primary findings of the study indicated a negative effect of RTI/MTSS implementation in the area of mathematics for all students and most significantly for Black students. In the area of reading, RTI/MTSS implementation had no effect on achievement growth of students with and without disabilities, and a substantial negative effect on the reading achievement growth of Black students compared to White students. In mathematics, significant classroom level predictors included teacher education (positive effect), teacher experience (negative effect), and percentage of females in the class (positive effect). Significant school level predictors included percentage of minority students (negative effect) and low SES (negative effect). In reading, significant classroom level predictors included teacher education (positive effect); teacher experience (negative effect); and percentages of females

(positive effect), racial/ethnic minority students (positive effect), and students with disabilities in the classroom (positive effects). No significant school level predictors were found for growth in reading achievement.

ACKNOWLEDGEMENTS

I have so many people to thank for the ongoing years of encouragement with my doctoral experience, but of course, Dr. Thomas Skrtic is at the top of my list. Shortly after moving to Kansas, I was feeling uninspired in my job as a school psychologist and my supervisor, Shelia Smith, suggested I take a class from Dr. Skrtic. Shelia said, “It does not matter what class you take, you will be inspired.” So, I took a class with Dr. Skrtic, found “my people” at the University of Kansas, and my life was forever changed. Dr. Skrtic’s knowledge of organizations and systems opened a new door for me and helped me begin to understand the complex nature of our education system and things that made so much sense to me were not working.

To say that Dr. Skrtic has put up with a lot from me is an understatement. During my doctoral experience, I was reassigned from my dream job into the most incredibly stressful and personally mismatched position I could have ever imagined. I was also diagnosed with cancer and experienced almost every side effect of chemotherapy possible, only to then go back and work in the incredibly stressful job. Dr. Skrtic has been on this journey with me and has patiently been there as I’ve had meltdowns via emails, and expressed fears of incompetence. Dr. Skrtic was never critical of me, even when I suffered from “chemo-brain” and struggled to articulate myself. Thankfully, he was also there to offer me encouragement in changing positions and finding another dream job and finally completing my dissertation! It has been a privilege to study with Dr. Skrtic.

Early in my time at the University of Kansas, I also met Dr. Chriss Walther-Thomas. Dr. Walther-Thomas also served as a source of inspiration to me, taught me about the imposter-syndrome that many of us suffer from, and always believed in me. Dr. Walther-Thomas and Dr. Skrtic both encouraged me to apply for an internship at OSEP, which I received and completed

and will always cherish that experience. I must also thank Dr. Argun Saatcioglu. I didn't always want to hear what he had to say to me and although I hate admitting this, he was always right!

I also need to thank my father, Jerry Henderson, for always believing in me and telling me how proud his is of me. Additionally, I could not have done this without my mentors and friends Joan Robbins and Dawn Miller; I am so fortunate to have you both in my life. Thank you for enduring this with me over the years and always being my cheerleaders!

Table of Contents

List of Tables	ix
List of Figures.....	x
CHAPTER 1 INTRODUCTION.....	1
Response to Intervention/Multi-Tier System of Supports	4
The Problem and the Study.....	5
Significance.....	8
CHAPTER 2 REVIEW OF THE LITERATURE.....	9
Response to Intervention	13
Foundational Research and Policy Issues Leading to RTI	14
Special Education Research and Policy Leading to RTI	17
From RTI to Multi-Tiered System of Supports	26
RTI/MTSS Implementation Monitoring	28
RTI/MTSS and SLD Diagnosis	31
Research on the Effects of RTI/MTSS on Student Achievement.....	33
Limitations of RTI/MTSS Research	39
CHAPTER 3 METHOD	42
Purpose and Setting	42
Sample and Variables	44
Analytic Strategy	49
CHAPTER 4 RESULTS.....	51
Sample and Survey	51
CHAPTER 5 DISCUSSION AND CONCLUSIONS.....	71
Discussion of Findings.....	71
Conclusions and Recommendations for Future Research	76

REFERENCES	82
Appendix A	96
Appendix B	98

List of Tables

Table 1: MAP Reading Descriptive Statistics	44
Table 2: MAP Mathematics Descriptive Statistics.....	45
Table 3: School Characteristics by School Composition Percentages	46
Table 4: Variables.....	48
Table 5: Survey Respondents	52
Table 6: Survey Factors.....	52
Table 7: Pairwise Comparisons of Cohorts on RTI/MTSS Implementation.....	54
Table 8: Mathematics Growth	65
Table 9: Mathematics Growth with Interactions	66
Table 10: Reading Growth	69
Table 11: Reading Growth with Interactions	70

List of Figures

Figure 1: Number of Respondents and RTI/MTSS Implementation Rating	56
Figure 2: Percent of White Students and RTI/MTSS Implementation Rating	57
Figure 3: Percent of Students on Free/Reduced Lunch and RTI/MTSS Implementation Rating	58
Figure 4: Percent of Students with Disabilities and RTI/MTSS Implementation Rating	59
Figure 5: Mean MAP Mathematics Score and Number of Respondents per Building	60
Figure 6: Mean MAP Reading Score and Number of Respondents per Building.....	61

CHAPTER 1

INTRODUCTION

The public education system that emerged in the last half of the nineteenth century virtually has been in a constant state of reform ever since (Tyack and Hansot, 1982). According to Tyack (1990), the first and most fateful reform effort was the early twentieth century “school reorganization” (p. 17) movement, which emerged to deal with the problems created by industrialization, urbanization, and immigration. Led by the “administrative progressives” (p. 17), the first generation of college-educated educational administrators, this very successful reform movement created by the 1950s the exclusive, inflexible, centralized, and closed bureaucratic system of public education that Americans have been trying to change since then (Tyack, 1990). This system was challenged first in the 1950s by the Supreme Court’s *Brown v. Topeka Board of Education* decision and then ostensibly reformed in the 1960s and 1970s by the Elementary and Secondary Education Act of 1965 (ESEA) and the Education for All Handicapped Children Act of 1975 (now Individuals with Disabilities Education Act [IDEA]), respectively. Although *Brown*, ESEA, and IDEA mandated a more inclusive, responsive, and participatory education system, what resulted was an even more bureaucratic, less flexible, siloed system in which inclusion and responsiveness is largely symbolic and ceremonial (Skrtic, 1991).

Less than a decade later, the highly influential Reagan administration report, *A Nation at Risk: The Imperative for Educational Reform* (National Commission on Excellence in Education, 1983), portrayed the public education system as a failing institution that threatened the economic and political well-being of the country. The report presented its discussion of reasons for the decline in U.S. public education in terms of the four broad areas of “content, expectations, time, and teaching” (p. 18), and also noted that the programs that have been created to address the

needs of diverse learners—ESEA and IDEA, in particular—often contribute to the problem by removing them from critical classroom instruction. Perhaps most significant was the report’s comparison of the achievement of American students to students around the world, which put national and global comparisons in the forefront.

Although *A Nation at Risk* (1983) did not provide recommendations for change, it is widely viewed as the impetus and justification for the current standards-based accountability approach to educational reform. That reform movement began with the 1994 reauthorization of the ESEA as the Improving America’s Schools Act and culminated in the 2001 reauthorization as the No Child Left Behind Act (NCLB) (Sunderman, 2010) and the linkage of NCLB and standards-based reform itself to special education in the 1997 and 2004 reauthorizations of the IDEA. Among other things, IDEA adopted the standards-based reform logic for students with disabilities by requiring that they be included in state and local testing with nondisabled students (Kleinhammer-Tramill & Gallagher, 2002). Two reports on the impact of the standards-based reform approach have appeared since its codification in law in the late 1990s and early 2000s. The first is the Council for Exceptional Children’s *Bright Futures for Exceptional Learners* (2000) report, which appeared after the initial codification of standards-based reform in the 1994 Improving America’s Schools Act and the 1997 reauthorization of the IDEA. The second report, *For Each and Every Child: A Strategy for Education Equity and Excellence*, was produced by the Equity and Excellence Commission (U.S. Department of Education, 2013). The Equity and Excellence Commission was created by Congress to advise the Secretary of Education on ways to close the achievement gap and address the imbalance of opportunities faced by many of America’s school children. Even though together the NCLB and IDEA explicitly seek to reduce the achievement gap between economically advantaged majority students and economically

disadvantaged racial/ethnic minority students and students with disabilities, both reports found that these worthy goals have not been achieved for either group of underachieving students.

These reports, like most others on American public education, underscore the need to improve the system (Cuban, 2013). However, the fact that the call for change so often has been met with such little success speaks to the daunting challenge of system reform, an undertaking plagued by an overly simplistic view of how to change complex organizations like schools and school systems (Cuban, 2013; Fullan, 2007; Senge, 2000). Lacking a systems perspective, decades of reform have done little to change teaching practices or student outcomes. However, the emergence of “systemic education reform” (Supovitz & Taylor, 2005, p. 205), a merging of 1970s and 1980s reforms that focused on educational inputs (e.g., length of school day, graduation requirements) and reforms of the 1980s and 1990s that focused on teacher professionalization and decentralization, offers a unique perspective for educational reform (Foster-Fishman, Nowell, & Yang, 2007). From this perspective, systems change, “an intentional process designed to alter the status quo by shifting and realigning the form and function of a targeted system” (p. 197), focuses on three critical areas: challenging standards, alignment between education policy and school governance, and the importance of local context (Supovitz & Taylor, 2005). At bottom, a systems perspective recognizes the complex and dynamic interplay of variables within any given context, the unique elements of which must be identified, understood, and attended to in order to achieve improved outcomes from complex systems (Foster-Fishman et al., 2007).

Response to Intervention/Multi-Tier System of Supports

In a 2005 report from the National Association of State Directors of Special Education (NASDSE), Batsche et al. describe a relatively recent systems change initiative being pursued in the U.S. public education system called “response to intervention [RTI] ... a practice of providing high quality instruction and interventions matched to student need, monitoring progress frequently to make decisions about changes in instruction or goals and applying child response data to important educational decisions” (p. 3). Although RTI was introduced in the 2004 reauthorization of the IDEA as a tool to identify children with specific learning disabilities (SLD), NASDSE subsequently conceptualized it more broadly as a school improvement process, noting that RTI “should be applied to decisions in general, remedial, and special education, creating a well-integrated system of instruction/intervention guided by child outcome data” (Batsche et al., 2005, p. 3). With the expansion of the RTI framework for school-wide application, the term “multi-tier system of supports” (MTSS) (Posny, 2007) emerged as the preferred term for the broader approach to school improvement.

Although considerable federal and state energy and resources have been devoted to RTI/MTSS promotion and implementation, there is little research on its effects as a systems change endeavor. That is, although research on separate elements of RTI/MTSS— universal screening (e.g., Lane & Menzies, 2003); tiered, researched-based instruction (e.g., Adeleman & Taylor, 1998); and progress monitoring (Fuchs, Hamlett, & Fuchs, 1994)—has demonstrated positive effects on student learning, research on its broader effects as an integrated school improvement system has been more limited.

Most research on the effects of RTI/MTSS has examined its impact on reading performance in early elementary grades and on the identification rate for students with SLD

(Hughes & Dexter, 2008). In terms of the application of RTI/MTSS in the diagnosis of SLD, there are concerns about the ability to apply its methods consistently enough in schools to be considered a valid diagnostic tool (Reynolds & Shaywitz, 2009; Wanzek & Vaughn, 2010). As for effects on student achievement, concerns have been raised about implementation fidelity, consistent application of instructional interventions (Noelle & Gansle, 2006; Reynolds & Shaywitz, 2009; VanDerHeyden, 2011), lack of actual data-based decision making (Thorius, Maxcy, Macey & Cox, 2014), and an overly simplistic sense of what constitutes learning and progress (Artiles & Kozleski, 2010). In addition, very few studies have been conducted on the effects of RTI/MTSS on the academic performance of all students in a school or district. (Mellard, Frey, & Woods, 2012).

The Problem and the Study

Systems change is an arduous and complex undertaking, and studying its impact presents its own set of challenges, especially when the system in question is a social program. Chatterji (2007) highlights the challenges of using randomized controlled trials to test the effects of social programs such as public education and their reform efforts. Issues highlighted include limited ability for random assignment, limited control on mobility of subjects in and out of school for reasons unrelated to the study, and overall difficulty controlling outside variables with potentially mediating or moderating effects on student and system outcomes. One solution to these difficulties is to use quasi-experimental or non-experimental designs with correlational analytical strategies, which are able to account for random error in variables out of the control of the researcher or evaluator (Chatterji, 2007; Lee, 2000).

Following Chatterji (2007), the analytic strategy of the study used a multiple regression analysis to examine the effects of degree of RTI/MTSS implementation on students' growth in

academic performance. Four models were fitted separately in a stepwise manner for both reading and mathematics. In the first model, only the degree of implementation and the achievement score were used. The subsequent three models added predictor variables at the individual, classroom, and school levels. This strategy was designed to help determine the extent to which individual, classroom, and school level factors contribute to the model and further explain variance. Then, a second set of procedures was applied to analyze the potential interaction between RTI/MTSS implementation and the individual level predictor variables of race, socio-economic status, and special education setting. This helped determine whether degree of MTSS implementation impacted groups of children differently.

The present study will contribute to research on RTI/MTSS by focusing on its effects on reading and mathematics achievement growth of all elementary students in an entire metropolitan district, including its potentially differential effects in different schools and at different grade levels, under teachers with different qualifications and years of experience, and on various types of students (e.g., students with and without disabilities, students from economically disadvantaged and advantaged families, students from majority and culturally diverse backgrounds). Moreover, it will consider the question of the effect of *degree* of RTI/MTSS implementation on achievement and do so at both the building level and at various grade levels within and across schools.

Purpose, Variables, Research Questions, and Analytic Strategy

The purpose of this research was to examine the effects of the degree of implementation of the RTI/MTSS school improvement model on student growth in reading and mathematics achievement. The setting for the research was the 33 elementary schools of a metropolitan school district of 27,419 students in a mid-western state. Degree of RTI/MTSS implementation,

the independent variable, was measured by the School Implementation Scale (SIS) (Gaumer-Erickson, Noonan & Jenson, 2012), which was completed by the administrator and teachers in each school. The individual-level dependent variables were reading and mathematics achievement growth from the 2012-2013 school year to the 2013-2014 school year as measured by Measures of Academic Progress (Northwest Evaluation Association, 2004), which is administered annually by the district. Achievement growth scores were generated by subtracting each student's reading and mathematics scores from the previous year and using the difference to represent a raw growth score. Control variables included: (a) student demographic characteristics (grade; age; race/ethnicity; SES in terms of free/reduced lunch status; disability status, type, and placement); (b) teacher demographic characteristics (grade-level taught, years of teaching experience, highest degree held, type of teaching license); (c) administrator demographic characteristics (years of administrative experience, highest degree held, type of administrative license); and (d) school demographic characteristics (calculated from student, teacher, and administrator demographic characteristics). The following research questions were addressed.

1. Are there differences in building-level and grade-level RTI/MTSS implementation?
2. How do school characteristics affect degree of school and grade-level RTI/MTSS implementation?
3. Does degree of grade-level RTI/MTSS implementation predict achievement growth in reading and/or mathematics for students with and without disabilities?
4. Does degree of grade-level RTI/MTSS implementation predict achievement growth in reading and/or mathematics for students with disabilities in more or less inclusive placements?

5. Does the degree of building-level RTI/MTSS implementation predict achievement growth in reading and/or mathematics for students with and without disabilities, and for students with disabilities in more or less inclusive special education settings?

Because students are nested in schools, the initial analytic strategy considered was hierarchical linear modeling (HLM) (Rabe-Hesketh & Skrondal, 2005; Raudenbush & Bryk, 2002). However, with only 33 buildings, there were an insufficient number of level-2 units (i.e., buildings) relative to the number of level-1 units (i.e., students). Given this “cell size” problem, ordinary least squares (OLS) regression was preferred over HLM. Nonetheless, school-level effects were accounted for by entering them directly into the linear (OLS) model. This approach is consistent with the main objectives of the study, which is to test the effects of degree of RTI/MTSS implementation on growth of students’ academic performance.

Significance

Although providing a quality education for all of America’s youth has been a national priority for decades, changing and improving our schools to meet this priority has been a difficult task. Schools are highly complex social systems and the design of school improvement and reform initiatives needs to take this into account if we are to impact such systems. The present study adds to the national knowledge base on the effects of RTI/MTSS by testing its effects on the academic growth of all students in an entire metropolitan school district at both the school and district level, by degree of implementation. The results of the study also advance understanding of how RTI/MTSS effects are differentiated by the interaction of school, professional, and student demographics. This will inform researchers and education decision makers nationally regarding the utility of RTI/MTSS as a school improvement approach and thus potentially affect the education of children throughout the country.

CHAPTER 2

REVIEW OF THE LITERATURE

Massachusetts passed the first compulsory school attendance law in 1852 and by 1890 most states had passed similar laws (Katz, 1976). Since then, the public education system that emerged over the late nineteenth and early twentieth century virtually has been in a constant state of reform, over which time school improvement and system reform have been topics of countless books and reports on education issued by state and national governmental agencies, universities, philanthropic foundations, and, more recently, private think tanks (Tyack, 1990). As early as 1910, when more than half of American children were educated in rural communities, there was a call to reform and improve rural schools.

It is not putting facts in too strong a light to say that the vast numbers of our rural boys and girls are annually turned out by the schools systematically dwarfed through more or less purposeless courses of study, leaving them poorly prepared for the life struggle. (Foght, 1910, p. 2)

Although Foght focused on the inequities between city and rural schools, it was the urban schools that became the primary focus of attention among the educational leaders of the time as they were dealing with the interactive problems created by industrialization, urbanization, and immigration.

In 1981, the United States Secretary of Education created the National Commission on Excellence in Education to study and report on the quality of education in the country. Later, in 1983, The Commission released what was perhaps the most influential report on the state of the American education system titled *A Nation at Risk: The Imperative for Educational Reform* (National Commission on Excellence in Education, 1983). This powerful report, written as a letter to the American people sparked both political and public interest by drawing an analogy

between the condition of public education in America and an act of war from a foreign country to increase awareness and create an atmosphere of urgency to improve schools.

In the report, The Commission set an expectation for excellence at the individual student level, school or college level, and for society as a whole. A strong and robust education system was envisioned as a mechanism for the country to “respond to the challenges of a rapidly changing world” (p. 14) and the term “learning society” (p.14) was used to capture the Commission’s vision of the benefits of a quality education system extending into the everyday life of American’s throughout their lifespan. The report provided statistics documenting the nation’s low literacy rates, highlighting that more than 20 million adults were functionally illiterate, declining college entrance exam scores, increasing enrollments in remedial math classes at the college level, and reports from military and business leaders on the cost of teaching new recruits and employees basic skills.

Written as a letter to the American people, the report presented its discussion of reasons for the decline in U.S. public education in the areas of: content, expectations, time, and teaching (p. 18). The Commission criticized the content of secondary programs stating that the course offerings for students lacked purpose and rigor. Criticisms regarding expectations included low graduation requirements, minimal time spent on homework, low college entrance requirements, the dumbing down of textbooks, and a lack of involvement from educators in the writing of textbooks. The school calendar and daily schedule were called into question as comparisons were made with other industrialized nations with American students spending fewer days per year and hours per day in school. Low pay, lack of expertise in content, and top performing high school and college students not going in to the field of teaching were criticisms about teaching. In addition to these criticisms the reported also noted that programs created to address the needs

of diverse learners—ESEA and IDEA, in particular—often contributed to the problems by removing students from critical classroom instruction. The report cautioned not to sacrifice equity in the name of quality, but rather that both could be achieved. Perhaps most significant was the report’s comparison of the achievement of American students to students around the world, which put national and global comparisons in the forefront.

After the initial codification of standards-based reform in the 1994 Improving America’s Schools Act and the 1997 reauthorization of the IDEA, in 1998, in response to mounting concern for the quality of instruction for students with exceptionalities and the unsatisfactory working conditions of special education teachers, the Council for Exceptional Children organized a Presidential Commission on the Conditions of Special Education Teaching and Learning to study the problem. The culminating report, *Bright Futures for Exceptional Learners: An Agenda to Achieve Quality Conditions for Teaching and Learning* (Kozleski, Mainzer, & Deshler, 2000), detailed problems and barriers to providing effective programs for students with disabilities since the introduction of standards based reform. The major findings included problems such as the following.

Ambiguous and competing responsibilities, overwhelming paperwork, inadequate district and administrative support, significant teacher isolation, insufficient focus on improved student outcomes, increased demand for well-qualified special educators, poorly prepared new general and special educators, and fragmented state and provincial licensing systems. (p. 3)

Additionally, a teacher shortage was identified and predicted to worsen in the early 2000s, a time when the need to focus on improved student outcomes was being brought to the forefront with the 1997 reauthorized IDEA applying the standards based reform logic to students with disabilities by requiring their inclusion in state and local testing (Kleinhammer-Tramill & Gallagher, 2002). The report included eight recommendations adopted by CEC, four of which

are relevant to the current topic, including “define the roles of special and general educators relative to students with exceptionalities, create the context for high quality practice, standardize decision-making processes, and provide systems supports” (p. 11). Many of the recommendations centered on the use of “research and experience validated” (p.12) practices for instruction, curriculum, and professional development. Similar to *A Nation at Risk*, the authors envisioned the solution as an American responsibility and identified actions for change from not only special education teacher and school and district leadership, but also for federal agencies, businesses, parents, professional associations, colleges and universities, and state and federal agencies. This broad sweeping call to action, again underscores the vision of America’s education system as impacting more than just the children in schools, but rather society at large.

In 2012, the U.S. Secretary of Education, Arne Duncan, appointed a commission to study and report on the state of educational equity on an in 2013, the Commission published their findings and recommendation in the report, *For Each and Every Child* (Equity and Excellence Commission, 2013). Similar to *A Nation at Risk* (National Commission on Excellence in Education, 1983), the report was written in an impassioned tone to convey the urgency and magnitude of the disparities facing special populations of students in America’s schools. The report indicated the growing population of English Language Learners (ELL) and provided documentation of the underachievement of these students. Additional issues of disparities and achievement and equity gaps included the continuing dismal performance of students with disabilities, achievement disparities between schools in high poverty areas compared to those in low poverty areas, and funding inequities between districts and states. Again, similar to *A Nation at Risk*, international comparisons were used to highlight America’s poor standing and lack of progress.

The Commission concluded:

For all of our initiatives and good intentions, our nation has been unable to ensure that each and every American child can attend a quality public school. Instead, both political parties, and all levels of government, have advanced reforms that, while well intentioned, have not risen to the level necessary to address the depth and breadth of the daunting challenges of equity and excellence facing American public education at the beginning of the 21st century. (p. 14)

The report provided recommendations for change and improvement at the local, state, and federal levels in the areas of school finance and efficiency, teaching and leadership, early childhood education, high poverty communities, and governance and accountability. It also highlighted the problem of over identification of children of color in special education and remedial programs. The Commission found that all too often such placements limited these children's access to quality curriculum that both addressed their need for basic skill development and provided interesting and rich content to stretch their skills, thus underscoring the necessity of accurate assessments of need and effective matching of interventions to assessed needs.

Response to Intervention

A relatively recent advance in the U.S. public education system is response to intervention (RTI). Formally codified into law with IDEA 2004 as an improvement in the methodology for the identification of children with specific learning disabilities (National Association of State Directors of Special Education [NASDSE], 2005; VanDerHeyden, Witt, & Gilbertson, 2007), RTI is seen by many as a solution to the unresolved problems noted in the section above (Jimerson, Burns, & VanDerHeyden, 2015). Since IDEA 2004, RTI has evolved into a means for school improvement and has been relabeled multi-tier systems of support (MTSS). At the most basic level, RTI is a set of procedures, systems, and organizational structures to ensure the needs of all students are being met. The universal principles in all RTI models include universal screening, tiered levels of interventions based on data and matched to

student need, progress monitoring, problem-solving and data-based decision-making, and readjusting the interventions based on data (Liu, Alonzo, & Tindal, 2011). The continuous review of student data at the individual, classroom, school, and district level provide the necessary information to not only provide students with needed support, but also to allocate resources to where they are needed the most (Batsche et al., 2005).

Foundational Research and Policy Issues Leading to RTI

More than four decades before the introduction of RTI, the academic community debated the merits of differing perspectives of research within the field of psychology. In his 1957 address to the American Psychological Association, Lee Cronbach, urged his colleagues to consider a model of research that used experimental and correlational methods to develop treatments by examining the interactions between them and the inherent characteristics of the individuals to which they were being applied. In principle, Cronbach's model commonly referred to as "aptitude treatment interaction" (ATI) (p. 681) designs treatments (interventions) specific to a person's measured ability (aptitude), which permits sorting individuals into ability groups for matched treatments. The concept of developing programs designed for specific populations based on their inherent characteristics was eventually applied in the educational realm and formed the foundation of special education (Reschly, 1998).

On the surface, ATI is an appealing and seemingly common-sense approach. However, less than 20 years later, in a follow up to his 1957 address, Cronbach (1975) identified unresolvable problems inherent in the ATI model.

An ATI result can be taken as a general conclusion only if it is not in turn moderated by further variables. If Aptitude x Treatment x Sex inter-act, for example, then the Aptitude x Treatment effect does not tell the story. Once we attend to interactions, we enter a hall of mirrors that extends to infinity. (p. 119)

What Cronbach recognized was that the ATI approach did not take into consideration the multitude of variables impacting the treatment outcomes for individuals, and thereby overestimated the strength of the relationship between aptitude and treatment. Instead of ATI, what Cronbach promoted was the use of “systematic inquiry” to study behavior in context in order to understand the interplay of the multitude of variables impacting behavior and outcomes.

Other researchers were following this same path. Both Urie Bronfenbrenner (1976) and Kurt Lewin (1943) advocated studying behavior as it occurred in natural environments (e.g., home, school, community) by carefully considering contextual variables when designing and conducting experiments. The concept of “mutual accommodation” (Bronfenbrenner, 1976, p. 9) was used to describe the process in which an individual functioning within a context changes and adapts to the environmental conditions as the environmental conditions change as well. The value of research conducted in controlled settings is acknowledged, but it is also noted that generalizing the results of such studies to natural settings like schools is limited (Lewin, 1943, Bronfenbrenner, 1976, 5). Bronfenbrenner coined the phrase “ecology of education” to describe the dynamic relationship that exists among social systems, such as neighborhood, home, and school.

Other scholars in the field of behavioral psychology that drew from this line of research included John Bergan and Thomas Kratochwill (1990) who proposed a “behavioral consultation model” (p. 4). Bergan and Kratochwill’s model of behavioral consultation is presented as a problem solving framework that includes four broad steps: problem identification, problem analysis, plan design, plan implementation, and problem evaluation. At the core of the model is the application of a systematic process of inquiry in order to understand, shape, intervene, and

ultimately change maladaptive human behavior. This process of systematic inquiry is a cornerstone of RTI (Batsche et al., 2005; Wedl, 2005; Fuchs & Fuchs, 2006).

Perhaps one of the most significant areas of research contributing to RTI is that of multi-tier instructional models (Batsche et al., 2005) which was maturing in the late 1990s. Significant work in this regard includes Adelman and Taylor's (1998) three-component model of community and school based mental health service delivery, Dickson and Bursuck's (1999) five-tier model for preventing reading failure, and the University of Texas' three-tier model of reading (2004). All of these models are grounded in a prevention orientation and recognition that a systems approach is a more efficient and productive way of targeting resources. "Multi-tier models provide the resource deployment strategies for efficient school-wide or system-wide implementation of RTI practices" (Batsche et al., 2005, p.12).

Another critical activity contributing to the RTI research base occurred in 1997 when Congress directed the National Institute of Child Health and Development and the U.S. Department of Education to form the National Reading Panel (NRP). The NRP was charged with scouring the research base to identify effective practices for teaching children to read. In 2000, the NRP's work culminated with the release of the *Report of the National Reading Panel* (2000), the most compelling aspect of which was research evidence on which reading skills should be taught and which instructional methods are the most effective.

In January 2001, shortly after the NRP report was published, the Elementary and Secondary Education Act was reauthorized as the No Child Left Behind Act (NCLB) with the goal of closing the achievement gap that existed for children living in poverty. NCLB applied the findings of the NRP report and explicitly stated that a key purpose of its Title I was to "ensure the access of children to effective scientifically based instructional strategies" (NCLB, p.

13). In what is perhaps the most explicit and direct connection between education policy and research to date (No Child Left Behind, 2001), the phrase “scientifically based research” appeared at least 50 times in the act. Taken directly from the NRP report, NCLB specified exactly which aspects of reading were critical skills to be taught in America’s schools. These skills included phonemic awareness, phonics, vocabulary, fluency, and comprehension.

Special Education Research and Policy Leading to RTI

Around the same time as Bergan’s (1977) formative work on behavioral consultation, Joseph Jenkins, Stanley Deno, and Phyllis Mirkin (1979) were developing a model of direct assessment of academic skills that would assist IEP teams with monitoring progress towards the goals and objectives in the IEP. This model of direct assessment also resulted in practices useful for identifying present levels of performance in order to make eligibility decisions as well as instructional modifications. At the core of this model is the concept of performance monitoring, which is a direct, frequent assessment of a child’s progress in a desired skill after an intervention has been implemented. Performance monitoring is another critical element in RTI systems and a key element when evaluating the effectiveness of a treatment or intervention.

As early as 1991, scholars in the field of behavior disorders began to identify problems with the prevailing classification system of the *DSM-III-R* that relied heavily on diagnosis of within child deficits and provided little insight into intervention (Gresham, 1991), and a model of “resistance to intervention” was put forth as an alternative (p. 9). As Gresham noted:

The goal of all interventions is to facilitate the momentum of desirable behavior and decrease the momentum of undesirable behavior. One can conceptualize resistance to intervention as being determined by response strength in relation to an intervention, applied to change a behavior. (p. 9)

Over the course of the next ten years, this logic was applied to the identification of students with specific learning disabilities (SLD).

In August 2001, the Office of Special Education Programs (OSEP) sponsored the Learning Disabilities Summit in response to mounting evidence of problems with the “IQ achievement discrepancy” approach to the identification of students with SLD. The goal of the summit was to bring together SLD stakeholders and the nation’s foremost experts in the field of learning disabilities, representing a variety of perspectives for an open dialogue on issues associated with the identification process. The experts who participated in the summit represented national professional advocacy organizations, university, foundation, and governmental researchers. Nine broad topics were discussed, including the discrepancy model of SLD identification and an alternative “response to intervention” model. Experts developed and presented a series of white papers to highlight problems with current SLD identification practices and to offer recommendations for solutions. Those calling for a change in the SLD identification process cited methodology that relied on a teacher based referral system that varied from teacher to teacher and contributed to a high error rate with inappropriate referrals, false positives, and false negatives resulting in inappropriate placements (Gresham, 2001).

Not long after the LD Summit, in October 2001, President George W. Bush issued an executive order creating the President’s Commission on Excellence in Special Education. The commission was given the task of studying and recommending policy changes at the federal, state, and local level that would lead to improvement in special education programs and the outcomes of children with disabilities. Included as one of the critical issues considered by the commission was the identification of students with SLD. Building on knowledge gained at the LD Summit and the work of this commission, the conceptual framework of RTI began to emerge formally. The final report, *A New Era: Revitalizing Special Education for Children and Their Families*, offered three broad recommendations: focus on results, not process; embrace a model

of prevention, not failure; and consider children with disabilities as general education children first. The Commission also made recommendations in seven critical areas of special education practice, one of which was assessment and identification.

Within the area of assessment and identification, the commission made four key recommendations: identify and intervene early; simplify the identification process; incorporate response to intervention; and incorporate universal design in accountability tools. The report indicated that complex requirements for determining eligibility for special education services were problematic. Additionally, the eligibility determination process was so complex that it hindered consistent implementation and application across the states. These findings lead to the recommendation for the use of RTI as part of the SLD identification process. Furthermore, the commission recognized that outcomes would be better for children if efforts were shifted from assessment of underlying cognitive processes toward assessment that led to meaningful instructional strategies. Over the course of the next few years, as the reauthorization of the Individuals with Disabilities Education Act took shape, RTI emerged as more than a tool for SLD identification.

With the reauthorization of IDEA in 2004, RTI was codified in law and through special education policy. Although the specific phrase “response to intervention” was not used in the law, use of RTI was made permissible in the IDEA with the following words:

In determining whether a child has a specific learning disability, a local educational agency may use a process that determines if the child responds to scientific, research-based intervention as a part of the evaluation procedures described in paragraphs (2) and (3). (p. 118)

This brief statement created the impetus and flexibility that educators and scholars needed to begin changing practices by implementing RTI in schools.

Two years later, the NASDSE took an active role in promoting RTI through two critical publications. The first was the *Response to Intervention* (Batsche et al., 2005) report noted above, which provided the field with a definition of RTI, general guidance for implementing RTI, and facilitating leadership of RTI at the state and local levels. NASDSE described RTI as “a practice of providing high quality instruction and interventions matched to student need, monitoring progress frequently to make decisions about changes in instruction or goals, and applying child response data to important educational decisions” (Batsche et al., 2005, p.3). In the report, RTI was conceptualized more broadly than in IDEA as a school improvement process rather than simply a tool to identify children with learning disabilities. “RTI should be applied to decisions in general, remedial, and special education, creating a well-integrated system of instruction/intervention guided by child outcome data” (Batsche et al., p. 3). With the expansion of RTI to include a school-wide application of the framework, the term “multi-tier system of supports,” or MTSS, emerged to describe the broader application (see below).

A second critical NASDSE publication was an annotated review of the literature base for RTI, *Response to Intervention: Research for Practice* (2007), composed of eighteen chapters that summarized the research on a variety of critical issues related to RTI and implementation. The following topics were included: problems with the prevailing identification model (IQ achievement discrepancy); the overrepresentation of racial and ethnic minority students in special education; student outcomes; tiers of instruction; treatment integrity; scaling up; and cautions. Each of the eighteen chapters was organized around the key issues of service delivery, implementation, and assessment. The purpose of this document was to facilitate understanding and application of the vast amount of information on the topic. Although RTI is a relatively new

educational phenomenon, as described earlier is it premised on a research base dating back at least 30 years and integrates concepts from a variety of fields of study.

Models of Response to Intervention

When RTI was initially conceptualized, two primary models were described in the literature: problem-solving and standard-protocol (Gresham, 2007). Although critical features vary, the two models share some commonalities. As indicated above RTI is broadly defined as the “practice of providing high-quality instruction and intervention matched to student needs and using learning rate over time and level of performance to inform educational decisions” (Batsche, et al, 2005, p. 5; National Association of State Directors of Special Education, 2007; Jimerson, Burns, & VanDerHeyden, 2007; Ikeda et al., 2007). Both models include the process of universal screening for academic or social emotional issues to identify students who are at risk. Both models recognize the importance of well-developed, research-based core instructional programs and both use supplemental research-based interventions to teach students at risk for academic failure and/or behavioral difficulties by providing additional support. Monitoring student progress in order to determine when to change the intensity of the intervention is also a critical feature of both models. The standard-protocol and problem solving RTI models both include tiers of instructional support, typically three, using researched-based approaches. As stated above, the process begins with universal screening, in which each student’s skills are identified and level of support is determined. Students who score below the benchmark are provided with a research-based intervention, which is often considered Tier Two. (Tier One is the universal core instruction that is provided to all students.) Students below benchmark receive the core program (Tier One) and the supplemental intervention (Tier Two). Progress is monitored frequently, and interventions are changed when the data indicate a change is necessary.

For example, some students make significant progress and the supplemental support is discontinued. Other students make adequate progress, but continue to need the additional support. Some students' response to the intervention is less than satisfactory and they require even more support. These students receive an even more intensive intervention (Tier Three) in order to meet the benchmark expectations. The departure between the two RTI approaches emerges at the point of intervention design.

With problem-solving RTI, after the screening data are collected, interventions are designed on an individual level through analysis of additional student performance data (Ikeda et al., 2007), student by student. An individualized decision-making process by a team of professionals, including the teacher, is a core feature in this model. Teams use a systematic problem solving process to analyze student data and brainstorm ideas for interventions. An advantage of this model is that the interventions are generated by a team of educators working with the student to customize the support to his or her individual needs.

Perhaps one of the earliest and most well-known applications of a problem solving process in schools was at the Heartland Area Education Agency (AEA) in Iowa (VanDerHeyden, n.d.). In a time of poor special education outcomes, dissatisfaction with the use of the aptitude treatment interaction model of disability identification used at the time, and improvements in functional assessment practices, Heartland's response was to formalize and implement a process of systematic inquiry to address the academic and behavioral needs of children in schools (Reschly & Tilly, 1998). Heartland's model used a four-level problem solving process, including consultation between the teacher and parents; consultation with building level colleagues such as the special education teacher; consultation with outside resources such as the school psychologist for more extensive problem solving; and only then, evaluation for special

education. The underlying logic is that greater student concerns require more perspectives and resources to develop interventions from a multidisciplinary perspective (Grimes, Kurns, & Tilly, 2006).

Standard-protocol RTI calls for standardized application of scientifically-validated, research-based interventions to address the instructional needs of children. “The standard-protocol approach relies heavily on interventions that can be administered in a certain specified format.... children are typically assigned to some additional instructional protocol that is a priori structured” (Jimerson et al., 2007, p. 44). Schools implementing standard-protocol RTI may have a variety of programs available that address the critical elements of academic areas such as reading (e.g. phonemic awareness, phonics, fluency, vocabulary, comprehension). Based on screening data, students who need intervention are grouped by area of deficit. As indicated by Shapiro, Zigmond, Wallace, and Marston (2011), the intervention is typically a program that has been commercially created, purchased, validated for use with moderately-sized groups, and evaluated by an outside source. An advantage of this approach is increased fidelity in the implementation of the intervention due to the clearly specified guidelines of the program (Fuchs, Mock, Morgan & Young, 2003; Shapiro et al., 2011). More in depth, diagnostic assessment of any particular student’s skills would typically happen after an intervention has been implemented and found to be unsuccessful.

The case for the superiority of the standard-protocol approach was advanced in the literature primarily by Fuchs et al. (2003), who do so indirectly by highlighting what they characterize as inadequacies of the problem-solving approach, through an analysis of research on the process. Ikeda and Gufstason (2002) conducted the first study considered on the problem-solving process implemented by the Heartland AEA. Drawing on two years of data, Ikeda and

Gustafson asserted the effectiveness of the model based on the number of students whose problems were resolved by general education teachers and thus did not require special education. Citing problems with sample size, variability of implementation of the problem-solving model, and how the researchers defined a “resolved” problem, Fuchs et al. called into question the conclusions of the study. A second critique is aimed at studies conducted on the problem-solving process implemented in the Minneapolis Public Schools (Marston, Muyskens, Lau, & Canter, 2003; Minneapolis Public Schools, 2001). Fuchs et al. criticized Marston et al. for their use of student achievement data that considered the performance of students receiving intensive intervention in different types of schools and full versus half-day kindergarten programs.

Whereas these and other analyses are no doubt important to the district’s ambitious effort to strengthen the reading performance of its young children, none seems to represent an evaluation of the PSM. (p. 165)

Additionally, no evidence was found in the studies regarding the outcome of students who actually received intervention based on problem-solving, information regarding implementation fidelity, or details regarding the actual interventions. On the basis of this analysis, they concluded that little evidence exists to demonstrate the model’s effectiveness and thus raised concerns about inconsistent implementation of its interventions. To counter the inadequacies of the problem-solving approach, they offered the standard-protocol model as superior because “everyone knows what to implement, and it is easier to train practitioners to conduct one intervention correctly and to assess the accuracy of implementation” (Fuchs et al., 2003, p. 166).

Although advocates for the standard-protocol model criticize the problem-solving model, there is no research on the effects of a strictly standard-protocol RTI model implemented by educators in real world settings. The closest instance in the literature is research on the System to Enhance Educational Performance (STEEP) (Witt & VanDerHeyden, 2007) RTI model,

which has elements of the standard-protocol model and was developed to address issues of reliability with the problem-solving model. Noting the problems of a referral process that relies heavily on individual teacher judgment and the multitude of problems inherent in a teacher-based referral system, the STEEP developers provided a more systematized referral process. Students are referred for evaluation after the application of a standard-protocol intervention. System issues that contribute to low achievement are the entry point for changing the achievement trajectory of at-risk children through the application of class-wide interventions. A class-wide intervention is applied after universal screening data indicate that the majority of students in a class fall below a predetermined benchmark. Individual or small group interventions are applied to those students whose progress monitoring data indicate they are not on track. The developers of STEEP claimed that class-wide universal screening is a more efficient use of resource than screening each individual student.

Based on research on progress monitoring, precision teaching, and functional analysis, STEEP developers sought to bring the “rigor of applied behavior analysis to education” (Witt & VanDerHeyden, 2007, p. 346) and thus a more systematic, research-validated, and replicable approach that can be applied consistently in a variety educational settings. Although this research on the implementation of STEEP showed that it results in decreased special education evaluations and that, when students are evaluated, they are more likely to qualify for special education (Witt & VanDerHeyden, 2007). Nevertheless, although the STEEP model relies heavily on standard-protocol interventions and decision rules, the developers refer to it as a “hybridized” (p. 351) model because individual student data, beyond just the class-wide screening data, are collected before a standard-protocol intervention is identified.

From RTI to Multi-Tiered System of Supports

Although debate over RTI model may continue, widespread agreement has emerged over the past decade about the utility of the collective, school-wide application of key RTI components—universal screening, problem identification, intervention implementation, monitoring student progress and implementation fidelity, and changing interventions and adjusting their implementation in response to student data—as a school improvement model that includes RTI as a disability determination process (Kovaleski, VanDerHeyden, & Shapiro, 2013; Sailor, 2009). What has emerged as a more viable model than either the standard-protocol or problem-solving approach is a hybrid of the two. “The emerging consensus ... is that the standard-protocol approach is best suited for Tier 2, and the problem-solving approach most useful at Tier 3” (Kovaleski et al., 2013, p. 25).

In August 2007, Alexa Posny, Commissioner of Education in Kansas, released a video briefly describing a multi-tiered system of support as a school-wide and/or district-wide application of RTI. The district-wide application of RTI is commonly referred to today as “multi-tier system of supports,” or MTSS. It is helpful to think of RTI as a conceptual model for decision making in the development of educational programs that are able to shift and adjust resources in response to outcome data. RTI is contextualized within MTSS, which provides the overall organizational framework. Averill and Rinaldi’s (2011) definition of MTSS captures the broad reaching impact of such a system.

In addition to offering a multi-tier approach to assessment and intervention, MTSS integrates a system-wide continuum of supports. This means that organizational structures are established that provide a continuum of support for removing the systemic challenges and barriers that hinder students’ success. Such structures activate home-school-community relationships and bring together partners from the education, mental health, family, social service, medical, juvenile justice, recreation, and cultural domains within the multi-tier system. These collaborations, together with educational leadership at the district and

school level, promote the formation of wraparound structures, supports, and practices to help students succeed in school. (p. 2)

For some time, RTI and MTSS appeared to be synonymous, but more recently the interrelatedness of the two concepts is being acknowledged and reinterpreted into the next generation of the multi-tier framework.

For example, Smart RTI (Fuchs, Fuchs, & Compton, 2012) is an academic, multi-level prevention model consisting of three tiers, which are described as “primary prevention, secondary prevention, and tertiary prevention” (p. 265). Primary prevention encompasses the core academic program, which includes any problem solving that occurs in order to differentiate, accommodate and motivate students at this level. They propose that this is unique to Smart RTI and suggest that differentiation, accommodation, and problem solving typically are features of Tier 2 in most other models. Secondary prevention involves supplemental small group instruction using research validated standard-protocol programs. Tertiary prevention is described as highly specialized instruction delivered by special educators with unique expertise. An integral component of Smart RTI is the use of a two-stage screening process to reduce false positives as well as predict which students would not be successful with the secondary prevention level and should be moved more quickly into tertiary prevention (projected to be about 5% of students). Smart RTI promotes a model addressing academic domains through clearly defined boundaries between levels of support and the expertise of the implementing educators.

A second model is Lane, Oakes, Jenkins, Menzies, and Kalberg’s (2014) Comprehensive, Integrated, Three-Tiered Model (CI3T) that addresses both the academic and behavioral domains simultaneously. CI3T is similar to other MTSS models in that it is a three-tiered approach based on universal screening of academic skills and behavior needs (attendance, office discipline

referrals, and behavioral screening tools). The tiers of support are organized and deployed to provide both academic instruction and behavioral supports for students. A distinguishing feature of the CI3T model is the consideration that is given to the broader educational context. That is, commitment to the restructuring process is first secured at the district level and then building level teams are developed to create a more tailored model based on local needs. “We emphasize [that] CI3T models are not a packaged program, but a blueprint for the school-site developed by CI3T teams that is customized to address the school’s goals for improvement and reflective of all of the schools offerings ...” (Lane et al., 2014, p. 132).

There has been some debate in the field regarding the underlying purpose of multi-tiered models and RTI. Fuchs, Fuchs, and Stecker (2010) identified two RTI groups with differing purposes—the IDEA group and the NCLB group—and concluded that neither group has a plan that is developed well enough to support students with the most significant needs. Both groups agree on the preventative nature of RTI as well as multiple levels of support, with the IDEA group emphasizing improved disability identification and the NCLB group emphasizing broader reform and school improvement. The levels of support differ between the groups, with the IDEA group suggesting seven levels of specialized expert support including self-contained classrooms in a school district as well as placements outside of the school such as special day school, residential school, and hospital setting.

RTI/MTSS Implementation Monitoring

In education reform, it is helpful to differentiate the key concepts of a program and a system or organization. The Joint Committee on Standards for Educational Evaluation provided the following definition of a program.

Defined completely, a program is a set of planned systematic activities; using managed resources to achieve specified goals, related to specified needs of

specific, identified, participating human individuals or groups, in specific contexts, resulting in documentable outputs, outcomes, and impacts following assumed (explicit or implicit) systems of beliefs (diagnostic, causal, intervention, and implementation theories about how the program works) with specific, investigable costs and benefits. (2011, p. xxiv)

The scope of a program can range from an individual child's special education plan to the broader scope of special education in the P-12 public school system.

A system or organization is defined as a complex set of parts that interact together to function as a whole and includes the people who function within them, the activities performed, and the settings in which they are performed (Foster-Fishman, Nowell, & Yang, 2007). On the surface, this definition is deceptively simple and further explanation of the complexity of a system is necessary. In public education, various systems exist to form systems within systems. For example, classrooms exist within a grade level at a particular school. Each classroom could be defined as a system on its own as each individual in that classroom contributes to the collective dynamic within the group. The ecology of each classroom is distinctly different from other classrooms with the individuals participating in activities unique to that particular setting. The same could be said of a grade level. Each teacher and the students within each class combine together to create a unique set of dynamics with a multitude of variables impacting how that unit functions collectively. Classes exist within grade levels, grades levels within schools, schools within districts, districts within neighborhoods, and neighborhoods within communities. This multi-level type of system is often referred to as a system of "nested layers" (Foster-Fishman et al., 2007, p. 203).

The study of organizations and planned organizational change (also called implementation research) has a long history in sociology (e.g., Meyer & Rowan, 1977), public policy (e.g., Pressman & Wildavsky, 1984), education (e.g., Clark & Guba, 1972), and special

education (e.g., Skrtic, Guba & Knowlton, 1985; Skrtic, 1991). More recently, research on school organization and change in education and special education has adopted the concepts and language of “systems” and “systems change.” Work from this perspective also is referred to as implementation research or, most recently, “implementation science,” a relatively new field (Coburn, 2003). The need to monitor the implementation of RTI/MTSS is well acknowledged in the literature (Sailor, 2009; Shapiro, Zigmond, Wallace, & Marston, 2011; VanDerHeyden & Tilly, 2010) and, just as system change is a complex and multifaceted process, so is the monitoring and evaluation of the implementation process.

One example of a tool created to monitor RTI/MTSS implementation is Sailor’s (2009) Schoolwide Applications Model Analysis tool (SAMAN). Relying on a team of trained evaluators conducting interviews, record reviews, and direct observations, SAMAN is used each semester to assess 15 critical features of the Schoolwide RTI Application Model (SAM). They include inclusive practices, organizational structures, curriculum, data-based decision making, culture, leadership, and family and community involvement. Marston, Casey, and Wallace (2011) of the Minneapolis Public Schools (MPS) used the RTI Readiness and Implementation: Self-Assessment Tool developed by the Pennsylvania Department of Education. “This tool describes ten indicators of readiness and implementation, which include: standards-aligned curriculum and research-based instruction, universal screening, shared ownership, data-based decision making, tiered intervention and service delivery, parent engagement, behavior, eligibility determination, leadership, and professional development activities” (p. 242). A third example of an implementation monitoring tool is that of Liu, Alonzo, and Tindal (2011), which they developed and validated based on six essential elements of their RTI implementation rubric. The analytic foci of the tool include “effective Tier 1 instruction, universal screening, effective

Tier 2 and Tier 3 interventions, progress monitoring, evidence-based decision making, and organizational support” (p. 343).

RTI/MTSS and SLD Diagnosis

Since being signed into law by President Gerald Ford in 1975, the subsequent reauthorizations of IDEA constitute an expansion of the law in terms of serving more children and increasing expectations for improved outcomes and school accountability for serving students with disabilities. In 1997, IDEA required states to include students with disabilities in state accountability systems. Although not a special education law, NCLB codified the requirement that students with disabilities be assessed and also set proficiency standards and held schools accountable for their progress. For the first time in the history of U.S. public education, the performance of students with disabilities officially mattered. This was not the only alignment of the IDEA with the NCLB. Other significant provisions that were added include an emphasis on scientific research-based instruction and whole school approaches to *prevent* the need for special education services. A third significant change occurred with the methods used to identify children with specific learning disabilities (SLD) by allowing the use of “a process that determines if the child responds to scientific, research-based intervention” (Individuals with Disabilities Education Improvement Act, 2004, p. 118). As such, RTI was seen as a system-wide framework for meeting the standards identified in NCLB as well as a model of preventing learning disabilities from occurring in the first place. The recognition that some learning disabilities could potentially be prevented constituted a paradigm shift that was perhaps fueled in part by years of research documenting the failures of special education as a whole.

Since IDEA was initially implemented over 40 years ago, the number of students with disabilities increased most during the initial years. In 1976-1977, 8.3% of the total school

enrollment was identified as having a disability. Over the course of the next decade, the numbers steadily increased to the all-time high of 13.8% in 2004-2005. Since then, the percentage of students with disabilities decreased, with recent statistics indicating that for three years from 2011 – 2014, 12.9% of the total school enrollment were students with disabilities (National Center for Education Statistics [NCES], 2015).

Of the 13 disability categories, none have experienced the fluctuations over time in number of students served as that of SLD. The largest increase in the number of students with SLD occurred during the first 15 years of IDEA, from a low of 21.5% of students with disabilities having SLD to a high of 45.5% in 2000-2001. Since then, the numbers have decreased at a rate of about 1% each year with the most recent data indicating about 35% of the students with disabilities have a SLD (National Center for Education Statistics, 2015). It is likely that the fluctuation in numbers is partly the result of the intensely debated eligibility criteria and the nature of SLD, and from the mid-2000s on, the introduction of RTI.

The method of diagnosing SLD that dominated the field from the late 1970s through the reauthorization of IDEA in 2004 was the “IQ achievement discrepancy” approach (Fletcher, Lyon, Fuchs, and Barnes, 2004). With advances in the measurement of academic skills, such as the advent of curriculum-based measurement (CBM), scholars and educators called into question the IQ achievement discrepancy approach (Ysseldyke & Marston, 1998), which rests on the assumption that measured IQ is fixed and therefore indicative of a child’s learning potential. University of Minnesota researchers developed CBM in the late 1970s and 1980s to monitor students’ progress on IEP goals, and in the development process found that when instruction and assessment are directly aligned, instructors can use assessment results to adjust and modify instruction to accelerate learning and improve outcomes for children with disabilities, who often

outperformed predictions based on IQ (Jenkins, Deno, & Mirkin, 1979). As such, the insights that emerged from development of CBM both called SLD diagnosis into question and became a foundation for RTI and, through it, for MTSS.

Research on the Effects of RTI/MTSS on Student Achievement

RTI/MTSS is the most recent attempt to address a long-standing, seemingly intractable problem in special education: the ineffectiveness of its instructional interventions. Before IDEA was enacted, special education programs for students with disabilities yielded dismal academic outcomes and suffered other programmatic difficulties. A 1962 review of 20 years of prior research indicated, “there is almost universal agreement that the mentally handicapped children enrolled in special classes achieve, academically, significantly less than similar children who remain in the regular grades” (Johnson, 1962, p. 66). Lloyd Dunn’s (1968) often-cited article—“Special Education for the Mildly Mentally Retarded: Is Much of It Justifiable?”—was the tipping point for the move away from the traditional special school/classroom model to the mainstreaming or continuum of services model of IDEA. Dunn pointed to three problems of special education policy and practice in the 1960s: ineffective instruction; psychological and social costs of labeling; and racial/ethnic and social class in the special education identification and placement process. With regard to the effects of IDEA on the academic outcomes of students with disabilities, nearly a decade after the law was enacted, Glass’s (1983) review of three meta-analyses of research on the effects of special education diagnosis, placement, and instruction, including psycholinguistic training, found that little progress had been made. Specifically, special education placement showed no academic benefit for the children so placed, and teaching methods based on differential diagnosis of cognitive skills “were unsupported by evidence” (p. 69). Interestingly, the psycholinguistic training studies did show some positive

effects; however, they were so minimal and the skills assessed so narrow Glass's interpretation was that psycholinguistic training was not worth implementing in a school setting. In their defense of special education programs and the continuum of services model a decade later, the best that Fuchs and Fuchs (1994) could say was that numerous studies indicate that special classroom placement improved the academic performance of some students, showed no positive effects on the performance of other students, and for still other students was clearly less beneficial than regular classroom placement. After another decade of similar results, Odom et al. (2005) speculated that the consistently discouraging results may indicate that research on the effectiveness of special education programs as a whole is particularly difficult to conduct due to the significant variability of the subjects (students) and the highly complex setting of public school.

Most recently and perhaps more significantly, results of the National Assessment of Educational Progress (NAEP) (Nation's Report Card, 2015), the gold standard of achievement tests, indicated that students with disabilities at the fourth-grade level experienced a statistically significant increase in reading performance from an average score of 184 in 2013 to an average score of 187 in 2015. Even with this increase, the academic performance of students with disabilities continues to be much lower compared to students without disabilities, whose 2015 average reading score was 228. The NAEP mathematics results show a similar gap between students with and without disabilities and no improvement from 2013 to 2015. The average score for students without disabilities was 244 compared to 218 for those with disabilities. Even with some gains for students with disabilities, overall their NAEP performance has been consistently lower than that of students without disabilities. These outcomes are even more concerning given the widespread implementation of RTI/MTSS, with 47 states implementing

some form of the model (McInerney & Elledge, 2013) and 13 requiring it for SLD diagnosis (Zirkel, 2013).

The research on the effects of RTI/MTSS on student learning has primarily examined its impact on the reading and mathematics performance in elementary school students and on the identification rates for students with SLD (Hughes & Dexter, 2008). Research on large-scale implementation of RTI/MTSS in Florida's Reading First schools (Torgeson, 2009) highlights data from the first three years of implementation that indicated fewer students were identified as needing special education services and fewer students were experiencing significant deficits in reading. In another multi-year study, Wanzek and Vaughn (2010) examined the effects of the implementation of a RTI three-tier reading model on special education identification rates. The researchers tracked three cohorts of kindergarten students for 5 years with one group serving as a control group and the other two receiving a three tier-reading model. As part of the three-tier reading model, the students with the most intensive needs were provided with additional small group reading instruction for 50 minutes daily. With regard to special education identification, although the results were not statistically significant, disability identification rates dropped from 19.37% to 14.18%. VanDerHeyden et al. (2007) found similar results regarding reduced special education evaluations and thus identifications, and higher diagnostic accuracy of students who were evaluated.

There is some evidence supporting RTI/MTSS as a promising practice for school improvement and for identification of children with SLD, but it is not without criticism. In terms of the application of RTI/MTSS in the diagnosis of SLD, there are concerns about the ability to apply the methods in schools consistently enough to be considered a valid diagnostic tool (Reynolds & Shaywitz, 2009). Although not identical to Glass's (1983) earlier criticism of

special education diagnosis, teacher effectiveness, and resulting identification and diagnostic inconsistencies across schools, criticism of RTI/MTSS diagnoses are similarly disconcerting. Glass's earlier conclusion that a child could be deemed disabled in one school and not disabled in another holds true for special education diagnosis under RTI/MTSS (Reynolds & Shaywitz, 2009).

There are very few studies that have been conducted on the effects of RTI/MTSS as an integrated system on the academic performance of all students in a school. One such study conducted by Mellard, Frey, and Woods (2012) selected from an initial pool of 60 schools in 16 states, five schools that demonstrated adherence to critical features of RTI/MTSS. Even with these attempts to choose schools that demonstrated some level of fidelity to RTI/MTSS critical features, the fidelity ratings of the five schools ranged from 39% to 72%, indicating a significant amount of variability in implementation. Mellard and colleagues reported three differential effects of RTI/MTSS on academic performance in the five adhering schools. The first was for three schools classified by the researchers as "high achievers and high gainers" (p. 28), that is, buildings that started the year with above average incoming achievement and outperformed the predicted growth that is typically seen in an academic year. The second type included one school classified as "lower performing, but higher gaining" (p. 28). In this case, incoming fall scores were below average, but the growth throughout the year represented above average gains. The third type of school was the most discouraging. Here, the incoming scores for the fifth school were described as above average but declining by the end of the year. Given performance gains in four of the five schools, including in the three high achieving schools and one low performing school, Mellard et al. concluded that RTI/MTSS is a promising practice. However, a complicating factor is that only one of these four schools had a RTI/MTSS fidelity rating greater

than 50% (i.e., 72%), while the ratings of the other three were between 39% and 49%. The authors did acknowledge that “ the sample schools’ procedures were sufficient, even if not complete, to be considered RTI” (p.19).

Other concerns have been identified regarding difficulty with implementation fidelity and ensuring the consistent application of an instructional intervention (Noelle & Gansle, 2006; Reynolds & Shaywitz, 2009). For example, ensuring that decisions are made in a timely manner so as not to delay an evaluation for special education and violate due process rights has been problematic. The problem in this regard is uncertainty about how much response to intervention is necessary before an evaluation for special education is initiated (Reynolds & Shaywitz, 2009). Perhaps one of the most concerning criticism is that, instead of replacing previous practices with more advanced ones, the cultural norms of schools are so engrained in the behaviors of educators that RTI/MTSS methods are being reinterpreted to fit rather than replace the existing structures and routines (Thorius, Maxcy, Macey & Cox, 2014). In their study, Thorius et al. used a “critical practice framework” to analyze a school’s RTI/MTSS implementation and found it contained many artifacts of the old special education pre-referral process. For example, the researchers found that educators engaging in student intervention meetings used deficit and disability oriented student descriptions (referring to students as “learning disabled” or “ADHD”) and demonstrated a lack of actual data-based decision making. Data from progress monitoring were acknowledged but not used to develop new and meaningful interventions for the student, giving credence to Reynolds and Shaywitz’s criticism of RTI/MTSS as a “watch-them-fail” (p. 130) model.

Most recently, the Institute of Education Sciences (IES) published findings from a large scale, multi-year study of the effects of RTI/MTSS in reading for early elementary students

(Balu, Zhu, Doolittle, Schiller, Jenkins, & Gersten, 2015). Several critical features of this study make it unique among RTI/MTSS research efforts (Balu et al., 2015). First, like Mellard et al. (2012), it studied the effects of RTI/MTSS as an integrated system at the school level. Second, in terms of sampling, the study included two types of schools implementing RTI/MTSS in grades 1-3, an “impact” sample and a “reference” sample. The purposively selected impact sample consisted of 146 schools from 13 states that had been implementing RTI/MTSS since 2009-2010. The schools were chosen through completion of a survey and an expert nomination process that included on-site visits to verify that critical elements of RTI/MTSS were actually being implemented. For a school to be included in the impact sample the following conditions were required:

use of three or more tiers of increasing instructional intensity to deliver reading services to students, assessment of all students (universal screening) at least twice a year, use of data for placing students in Tiers 2 or 3, [and] use of progress monitoring (beyond universal screening) for students reading below grade level to determine whether intervention is working for students placed in Tier 2 or 3. (p. 16)

Of the initial 184 schools receiving on-site visits, 146 met all research criteria to be included in the study. The reference sample, which consisted of 1,105 schools from the same 13 states that completed the same survey as the impact schools, was selected to serve as a comparison group and to be representative of all public elementary schools in the respective states. Interestingly, due to the surge in implementation of RTI/MTSS, 56% of the reference sample also reported full implementation of RTI/MTSS.

A third defining characteristic of the IES study was the requirement that schools had to have adopted and implemented RTI/MTSS on their own. This requirement provides a real world context rather than the more artificial situation in previous studies, which rely on experimental control and implementation. A fourth important feature of the IES study was the statistical

analysis. A regression discontinuity design was used to compare the performance of students just below and just above decision criteria cut points for inclusion in tiered interventions, with students performing just below the cut point comprising the experimental group (receiving interventions), and those performing just above the cut point comprising the comparison group (not receiving interventions). This analytic strategy created two groups for comparison with relatively similar scores, with only one group receiving the treatment. As the study principals noted, an advantage of the regression discontinuity design is that causation may be inferred.

In addition to documenting the prevalence of RTI/MTSS practices in the sample, the key research question was: “For students who fell just below school-determined standards for each grade on screening tests, what were the effects on reading achievement of actual assignment to receive reading intervention services (in addition to core instruction)?” (p. 87). Quite unexpectedly, results indicated that the reading achievement of students who received the tiered intervention supports was negatively affected by receiving them. These results were similar to the schools classified as “above average, with declining performance” in the Mellard et al. (2012) study, where RTI/MTSS intervention decreased academic performance.

Limitations of RTI/MTSS Research

Until recently, most research on RTI/MTSS effects has examined a particular aspect of the model and not the achievement effects of RTI/MTSS as a whole (Deshler, 2015). According to VanDerHeyden et al. (2007):

There are at least two problems with the research thus far conducted in support of RTI models. First, implementing RTI means implementing an integrated set of procedures or components while correctly applying sequenced decision rules. The research conducted to date with few exceptions has focused primarily on the efficacy of the components individually but not on the efficacy of the RTI process as an integrated whole. (p. 226)

Moreover, while research on separate elements of RTI/MTSS has shown positive effects on student learning (Adeleman & Taylor, 1998; Dickson & Bursuck, 1999; Fuchs, Hamlett, & Fuchs, 1994; Lane, Gresham, & O’Shaughnessy, 2002; Lane & Menzies, 2003), the most comprehensive study of the effects of RTI/MTSS as an integrated system, the IES study (Balu et al., 2015) described above, found that RTI/MTSS tiered intervention supports negatively affected the reading achievement of students who received them.

Although the IES study’s (Balu et al., 2015) large scale, multi-year design represents an advance in RTI/MTSS research, it has several limitations. One limitation is the narrow scope of sampled students and the subjects considered—first through third grade reading only, which doesn’t allow for application of the results to the broader student population and other subject areas. Additionally the regression discontinuity technique further narrows the sample by only considering the performance of students just below and just above the cut point, which also limits generalization of the results. A related limitation is that, although Balu et al. studied RTI/MTSS as an integrated system at the school level, it did not study its effects on all the students in the sampled schools.

In the recently updated *Handbook of Response to Intervention* (Jimerson et al., 2016), the authors cite several additional areas of limitation in the current body of research on RTI/MTSS effects, including a lack of research on the reliability and validity of team decision-making and on the structures that contribute to timely and accurate decision-making (e.g., grade level teams, professional learning communities). According to the authors, research also is lacking on how schools determine cut-scores for the identification of students to receive interventions and for movement between tiers. This is important because lack of clarity about determination of cut-

scores and/or faulty cut-score selection processes can lead to students being over- or under-identified for inclusion in intervention groups.

Although the present study does not address all of the limitations indicated, it does address a few critical areas. First, the present study estimates growth from one school year to the next rather than only considering the fall to spring scores of one school year. For example, the IES study examined only one academic year by comparing fall screening scores of each student to an outcome measure. Second, Jimerson et al. (2007) state that MTSS emerged as a broader application of RTI to whole-school reform efforts. As such, examining the effects of RTI/MTSS on the academic achievement of all students is indicated by the logic of the model. The present study does just that by analyzing data on the impact of the effects of RTI/MTSS on the reading and mathematics achievement growth of all students in third through sixth grade for an entire metropolitan school district, rather than a narrowly defined subgroup of students or special populations. Third, the present study included reading and mathematics rather than just reading. There is far more research on RTI/MTSS effects on reading achievement than on performance in mathematics, which makes this an important area of needed research in the field (Fuchs, Fuchs, & Malone, 2015).

CHAPTER 3

METHOD

The literature on RTI/MTSS largely addresses either its effects on the academic performance of students at risk for reading difficulties (Tran, Sanchez, Arellano, & Swanson, 2011) or its utility for identifying students with learning disabilities (VanDerHeyden et al., 2007; Lindstrom & Sayeski, 2013). No studies were found on district-wide effects of RTI/MTSS on the reading and mathematics performance of all students. The present study contributes to the research on RTI/MTSS by focusing on its effects on growth in reading and mathematics achievement of all third through sixth grade students in an entire metropolitan district, including its potentially differential effects in different schools and at different grade levels, under teachers with different qualifications and years of experience, and for various types of students (i.e., students with and without disabilities, students from economically disadvantaged and advantaged families, students from majority and culturally diverse groups). Moreover, the present research considers the question of the effect of *degree* of RTI/MTSS implementation on achievement and does so at both the building level and at various grade levels within and across schools.

Purpose and Setting

This study examines the effect of the degree of implementation of the RTI/MTSS school improvement model on student achievement growth in reading and mathematics. The setting for the study included all 33 elementary schools of a metropolitan school district located in a plains state. The district began implementing a standard-protocol RTI model in the area of reading during the 2006-2007 school year with five pilot schools, Cohort 1. The standard-protocol model, which included predetermined decision criteria and intervention programs, was based on the System to Enhance Educational Performance (STEEP) model. Nine additional schools

(Cohort 2) began implementing during the 2007-2008 school year and the standard-protocol model was replaced with a hybrid standard-protocol/problem-solving model, and was renamed RTI/MTSS to reflect the language used by the state and to communicate that it was a broader school improvement effort. There continued to be predetermined decision rules and standard interventions, however, additional elements were added to allow for more data-based professional judgement and problem analysis by the building teams.

During the 2008-2009 school year the remaining 21 elementary schools (Cohort 3) began implementing the RTI/MTSS model and the area of mathematics was added. Two schools closed during the 2010-2011 school year and merged with existing buildings. Cohorts 1 and 2 received additional training for the area of mathematics. Differentiated staff development was provided to all three cohorts' schools as well as onsite training. Each building established a multidisciplinary RTI/MTSS leadership team and a trainer of trainers model was used in which, after receiving initial training, members of the building leadership team trained building personnel. Training materials were provided to the building leadership team and onsite coaching was available upon request. The professional development curriculum addressed district-identified critical features of RTI/MTSS, including teaming and core beliefs, intervening early, developing a model of support (e.g., master schedule), evidence based practices, data-based decision making, and problem solving. Expectations were established that included addressing students' needs at the classroom, small group, and individual level. Tools were developed to facilitate decision making and included developing inclusive practices, grouping students based on data, matching needs to interventions, designing interventions, monitoring progress, and analyzing responses to intervention.

Sample and Variables

The sample for the dependent variable—growth in reading and mathematics achievement measured by performance on the Measures of Academic Progress (MAP) (Northwest Evaluation Association, 2004) reading and mathematics tests from academic year 2012-2013 to academic year 2013-2014—including the 7,807 first through sixth grade students who took the reading test and the 7,587 students in these grades who took the mathematics test in *both* academic years (see Tables 1 and 2, first column). The district’s RTI/MTSS process required schools to screen all students three times per year in first through sixth grade with the Dynamic Indicators of Basic Early Literacy Skills (DIBELS), and at least once per year with the MAP reading and mathematics tests in third through sixth grades). Individual schools had flexibility with how they used the MAP in kindergarten through second grade and it was a common practice for schools to use the MAP for planning and screening purposes in those grades. Kindergarten was dropped for lack of a sufficient number of tested students.

Table 1: MAP Reading Descriptive Statistics

	<u>2013 - 2014 MAP Reading</u>									
	<u>Students</u>		<u>Mean</u>		<u>SD</u>		<u>Min - Max</u>			
	<u>2013</u>	<u>2014</u>	<u>2013</u>	<u>2014</u>	<u>2013</u>	<u>2014</u>	<u>2013</u>	<u>2014</u>	<u>2013</u>	<u>2014</u>
1st	15	18	184	196	20	15	142	212	171	232
2nd	764	920	190	189	16	16	140	223	141	242
3rd	1,779	2,093	194	194	15	15	134	238	141	234
4th	1,753	2,004	204	205	14	14	143	242	148	238
5th	1,759	1,949	212	212	13	14	148	246	149	246
6th	1,737	1,980	217	217	13	13	154	250	150	253

Table 2: MAP Mathematics Descriptive Statistics

	<u>2013 - 2014 MAP Mathematics</u>									
	<u>Students</u>		<u>Mean</u>		<u>SD</u>		<u>Min - Max</u>			
	<u>2013</u>	<u>2014</u>	<u>2013</u>	<u>2014</u>	<u>2013</u>	<u>2014</u>	<u>2013</u>	<u>2014</u>	<u>2013</u>	<u>2014</u>
1st	16	17	185	189	18	11	147	213	161	207
2nd	548	822	190	191	13	13	147	220	139	235
3rd	1,775	2,092	195	196	11	12	150	234	137	240
4th	1,753	2,005	208	209	11	12	155	267	162	275
5th	1,756	1,947	218	219	12	14	160	263	159	272
6th	1,739	1,974	225	225	12	13	168	266	163	272

Predictor variables included gender, race, socioeconomic status (SES), disability status, teacher education, teacher experience, social class, gender, percent of racial/ethnic minority students in the class, percent of students with disabilities in the class, percent of students with free or reduced lunch in the class, percent of racial/ethnic minority students in the school, percent of students with free or reduced lunch in the school, percent of students with disabilities in the school, and school SES. The demographic make-up of each school is presented in Table 3. The data include, by anonymous student number, percentages of student in each racial category, percentage of students in the building with disabilities (SWD), and percentage of students in the building who received free or reduced lunch, an indicator of poverty (SES).

As noted in Table 4, degree of RTI/MTSS implementation, the independent variable, was measured using the School Implementation Scale (SIS) (Gaumer-Erickson, Noonan & Jenson, 2012) administered to 840 teachers and 33 administrators. Grounded in effective schools research, Gaumer-Erickson and colleagues developed the SIS to address key limitations of common RTI/MTSS implementation evaluation practices, one of which is time. Common

Table 3: School Characteristics by School Composition Percentages

<u>School ID</u>	<u>White</u>	<u>Hispanic</u>	<u>Black</u>	<u>Others</u>	<u>SWD</u>	<u>SES</u>
1	84.1	4.3	0.8	10.8	3.9	9.0
2	58.2	27.8	7.0	6.9	7.6	51.6
3	84.0	6.5	1.1	8.4	5.7	14.2
4	91.7	4.5	1.1	2.7	3.8	8.6
5	85.9	7.4	1.0	5.7	5.3	15.9
6	91.6	3.7	1.0	3.7	4.0	7.5
7	69.1	17.9	3.6	9.4	6.0	24.7
8	87.8	5.8	3.0	3.4	6.6	16.7
9	92.4	2.7	2.0	2.9	4.1	8.5
10	52.0	20.9	11.4	15.7	8.3	55.2
11	52.2	22.7	10.5	14.6	6.8	61.2
12	51.6	26.1	11.8	10.5	8.7	63.7
13	70.9	16.6	3.8	8.7	10.8	51.3
14	60.3	25.2	8.2	6.3	9.0	51.1
15	68.7	14.9	6.1	10.3	11.6	40.1
16	57.4	24.4	7.6	10.6	11.1	56.9
17	57.7	18.6	12.3	11.4	7.9	54.0
18	73.3	14.1	4.4	8.1	4.6	29.1
19	48.5	29.3	12.7	9.5	10.5	55.5
20	75.3	12.5	3.7	8.5	7.4	30.9
21	43.3	38.3	11.1	7.3	10.0	73.8
22	69.1	11.1	9.4	10.3	7.5	30.0
23	22.1	52.3	16.8	8.9	9.7	82.1
24	42.3	27.9	18.4	11.4	7.9	71.1
25	41.5	36.3	12.2	9.9	7.6	64.3
26	26.5	48.4	17.7	7.4	6.8	84.4
27	77.8	7.7	5.6	8.8	11.2	30.3
28	80.8	7.6	1.6	10.0	5.4	12.9
29	78.5	6.9	5.8	8.8	8.8	16.5
30	50.6	21.7	17.1	10.6	7.0	57.9
31	46.0	9.0	32.4	12.6	10.4	53.8
32	65.5	10.7	13.6	10.2	8.5	32.7
33	69.1	21.1	5.2	4.5	8.2	54.7
TOTAL	63.3	19.0	9.0	8.8	7.7	42.8

evaluation practices involve a multifaceted data collection process that uses checklists, observations, and interviews. While these procedures yield valuable information, they are often

time consuming and expensive for schools (Gaumer-Erickson et al.). A second problematic feature of common evaluation procedures is that “existing fidelity measures focus on the perceptions of a small group of individuals that constitute the school leadership team” (p. 36). The SIS is administered to all school personnel, which provides valuable input from the people who are actually conducting instruction, data collection and analysis, and working directly with children and families. The SIS also provides information regarding the school improvement principles of school culture, ongoing professional development, evidence-based practice, and family engagement, as well as information regarding school, classroom, and student levels of implementation. In terms of reliability, Cronbach’s alpha coefficients for the essential elements and levels of implementation portions of the SIS ranged from .808 to .961, and reliability by role of respondent yielded similarly high coefficients of .90 for teachers, .929 for administrators, .953 for other certified staff and .970 for noncertified staff. Results regarding validity are not provided, however.

Student reading and mathematics achievement growth, the individual-level dependent variables, was measured with the MAP. Test-retest reliability estimates on the reading test ranged from .80 to .91 from fall to spring and from .87 to .91 spring to spring. Concurrent validity when compared to 13 different standardized norm referenced group achievement tests ranged from .66 to .87 on the reading tests and from .72 to .88 on the mathematics tests (Northwest Evaluation Association, 2004). The achievement growth score was generated by subtracting each student’s 2013 score from their following year’s score and using that to represent a raw growth score (raw growth score = 2014 MAP score – 2013 MAP score).

The disability and inclusion variables were generated according to each student’s individualized education program. The number of students who were removed from the regular

education program less than 21% of the time totaled 707, the number who were removed 21% - 61% of the time totaled 233, and the total number of students removed from the regular education program for more than 61% of the time was 48, with only one of these students having a MAP score for two consecutive years.

Table 4: Variables

Independent Variable	
Implementation	Mean building score on survey (continuous)
Dependent Variable	
MAP Score	Equal interval, vertical Rasch Unit Score (RIT) for reading and mathematics
Student Level Predictor Variables	
Race	0 = white, 1 = Hispanic; 2 = Black; 3 = Other
Gender	0 = male, 1 = female
SES	0 = full pay lunch, 1 = free/reduced lunch
Disability & Inclusion	0 = Non-disabled; 1 = Disabled & < 21% in sped setting; 2 = Disabled & 21-61% in sped setting
Class Level Predictor Variables	
Teacher Education	1 = BA/BS; 2 = MA; 3 = Ed.S.; 4 = Ph.D.
Years of Experience	Years at Current School
Class - Female	Percent of females in the class
Class Minority	Percent of minorities in the class
Class - SES	Percent of students in the class receiving free/reduced lunch
Class Disabled	Percent of students in the class with disabilities
Building Level Predictor Variables	
School SES	Percent of students in the school receiving free/reduced lunch
School Disabled	Percent of students in the school with disabilities
School Minority	Percent of minority students in the school

The following research questions were addressed:

1. Are there differences in building-level and grade-level RTI/MTSS implementation?
2. How do school characteristics affect degree of school and grade-level RTI/MTSS implementation?
3. Does degree of grade-level RTI/MTSS implementation predict achievement growth in reading and/or mathematics for students with and without disabilities?
4. Does degree of grade-level RTI/MTSS implementation predict achievement growth in reading and/or mathematics for students with disabilities in more or less inclusive placements?
5. Does the degree of building-level RTI/MTSS implementation predict achievement growth in reading and/or mathematics for students with and without disabilities, and for students with disabilities in more or less inclusive special education settings?

Analytic Strategy

Multiple regression analysis was used to examine the effects of degree of RTI/MTSS implementation on students' growth in academic performance. Four models were fitted separately in a stepwise manner for both reading and mathematics. In the first model only the degree of implementation and achievement scores were used. The subsequent three models added predictor variables at the individual, classroom, and school levels. This strategy involved testing four consecutive models, fitted separately on mathematics and reading scores and for school-level degree of RTI/MTSS implementation. Model 1, the *null* model, provided baseline measures for the variance in the dependent variable explained by implementation. Models 2, 3, and 4, when contrasted to Model 1, helped determine the degree to which the individual, classroom, and school level factors included in the study contribute to the model and further

explain variance.

Finally, four interaction terms were added to the models to assess the potential interaction between RTI/MTSS implementation and the individual level predictor variables of race, socio-economic status, disability status, and special education setting. This helped assess whether degree of RTI/MTSS implementation impacted groups of children differently.

CHAPTER 4

RESULTS

The primary focus of this study was to examine the effects of district-wide implementation of RTI/MTSS on reading and mathematics achievement growth for elementary students. The outcome measure was growth in student performance on the Measures of Academic Progress (MAP) reading and mathematics tests for all first through sixth grade students assessed in two consecutive school years, 2012-2013 and 2013-2014. The independent variable was level of RTI/MTSS implementation as measured by the School Implementation Scale (SIS) (Gaumer et al., 2012), as adapted on the basis of an exploratory factor analysis conducted by the researcher (see below). Control variables included: gender, race, SES (i.e., percent of students who received free or reduced lunch, an indicator of poverty), disability status, special education setting, teacher education, teacher experience, class gender composition, class racial/ethnic minority composition, class disability composition, school minority composition, school SES composition, and school disability composition. Interaction effects of level of implementation with the individual student characteristics of race, SES, disability status, and special education placement setting were also examined.

Sample and Survey

Initially, there were 443 respondents to the survey. After eliminating partially completed surveys and respondents who were not assigned to particular buildings there were 400 fully completed surveys, which represented a response rate of 45.8%. Of the 33 buildings, the range of respondents was 3-17 per building. As indicated in Table 5, 70.75% of the respondents were classroom teachers, and the remaining 29.25% were administrators (7.50%) and special educators and other specialists (21.75%).

Table 5: Survey Respondents

Principals	17	4.25%
Special Education & Other Specialists	100	25.00%
Classroom Teachers	283	70.75%
Kindergarten	(40)	14.13%
1 st Grade	(42)	14.84%
2 nd Grade	(40)	14.13%
3 rd Grade	(43)	15.19%
4 th Grade	(38)	13.43%
5 th Grade	(35)	12.37%
6 th Grade	(45)	15.90%

Exploratory factor analysis was conducted to examine the question loadings on the original factors identified by the survey developers. Gaumer et al. (2012) originally identified the categories of school culture, ongoing professional development, evidence-based practices, and family engagement. The extraction method used was principal axis factoring. Promax with Kaiser normalization was the rotation method used. The goal of the factor analysis was to examine the factor loadings and reduce cross loading of questions on multiple factors as much as possible. While continuing to maintain four factors, as with the original survey, the factor analysis reduced the survey to 25 questions with very little overlap of questions between factors. To distinguish the factors from those in the original survey they were renamed as indicated in Table 6, along with the average score based on the 400 responses.

Table 6: Survey Factors

Factor	Mean
Meeting Needs with Evidence-Based Practices	3.7
Coaching Received	3.1
Involvement-Collaboration	4.26
Family Communication	4.17
Total Survey	3.78

Fifteen questions fell under the first factor, with only one of those questions falling under another factor. The questions in this factor, Meeting Needs with Evidence-Based Practices, asked for the respondents' perceptions regarding the academic and behavior needs of students and the school and grade level team's ability to meet those needs with evidence-based practices. Additionally, questions regarding the perceptions of the administration's commitment to implementing a tiered system were addressed. Three questions fell within the second factor, Coaching Received, and specifically asked whether the respondent received coaching to implement evidence-based practices and tiered levels of support within the academic and behavior domains. The third factor, Involvement-Collaboration, consisted of five questions, with one question overlapping with another factor. These questions related to how much involvement the respondent had in action planning, collaboration with colleagues, and having an understanding of the system of supports. The final factor, Family Communication, consisted of three questions specifically asking about communication with families regarding academic and behavior progress as well as the extent to which decisions were made based on the feedback that was received from the family.

Findings

In this section, findings are reported relative to each of the five research questions noted in Chapter 3.

Research Question 1: Are there differences in building-level and grade-level RTI/MTSS implementation? ANOVA was used to determine whether there were differences in implementation between grade levels and between buildings. Although there were no statistically significant differences between grade levels, there were statistically significant differences in RTI/MTSS implementation between buildings ($F(32,365) = 2.80, p = .000$),

indicating that the modified survey continued to be sensitive to implementation differences between buildings. Since grade-level differences in survey results were not statistically significant, the remainder of the analysis is based on building-level implementation.

RTI/MTSS was initially implemented over the course of three academic years with three cohorts of schools, each starting in a different year, respectively. Related to the question of building-level differences in implementation, analyses were conducted to determine whether differences existed between the cohorts of buildings with regard to response patterns on the implementation survey, using pairwise comparisons based on the average response for each cohort (Table 7). The differences between Cohort 1 and 2 were statistically significant as shown below; however, with regard to effect size this difference was negligible given the scale of the survey. This indicates that the survey was not sensitive enough to detect differences in implementation between the cohorts, therefore negating analysis at the cohort level.

Table 7: Pairwise Comparisons of Cohorts on RTI/MTSS Implementation

	Mean	Comparison	Scheffe	
			t	P> t
Cohort 1	3.21	2 vs 1	2.34	0.066
Cohort 2	3.66	3 vs 1	1.45	0.352
Cohort 3	3.47	3 vs 2	-1.62	0.27

Research Question 2: How do school characteristics affect degree of school and grade-level RTI/MTSS implementation? The mean survey score per building ranged from 3.24 to 4.87 with an overall mean of 3.78 and a standard deviation of 0.63. The number of respondents per building ranged from 3 to 26. However, as indicated in Figure 1, the number of respondents did not have an impact on the overall degree of MTSS implementation, which is to be expected given that degree of school-level implementation is the building mean survey score. Figures 2,

3, and 4 represent the relationship between key school characteristics and mean building implementation score. The only building characteristic that appears to have a relationship with implementation of RTI/MTSS is the percent of students with disabilities in the building, which was negatively related to level of implementation—buildings with a higher percent of students with disabilities had lower scores on the implementation survey. Figures 5 and 6 represent the relationship between number of respondents and MAP mathematics and reading scores, respectively. In both cases, number of respondents increases as MAP scores decline.

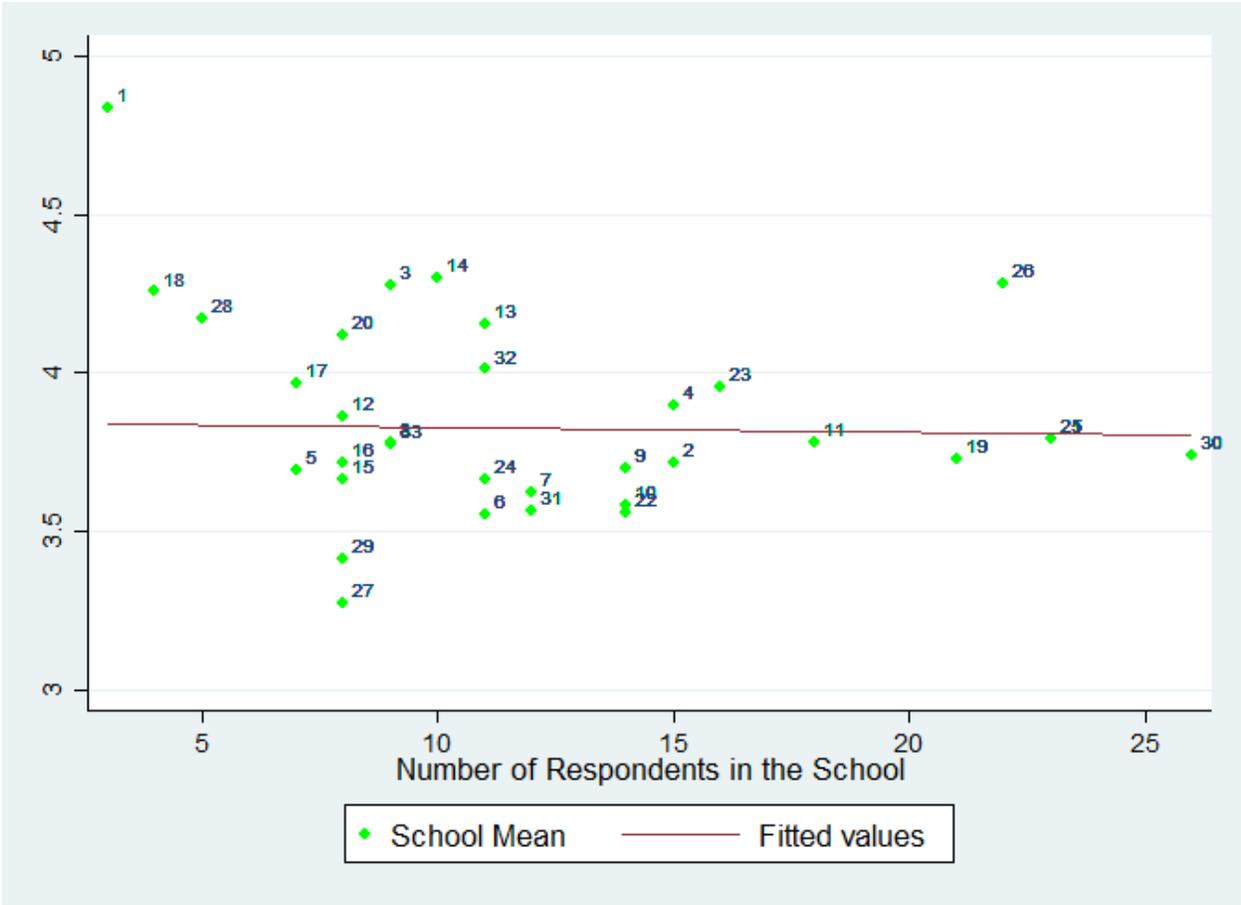


Figure 1: Number of Respondents and RTI/MTSS Implementation Rating

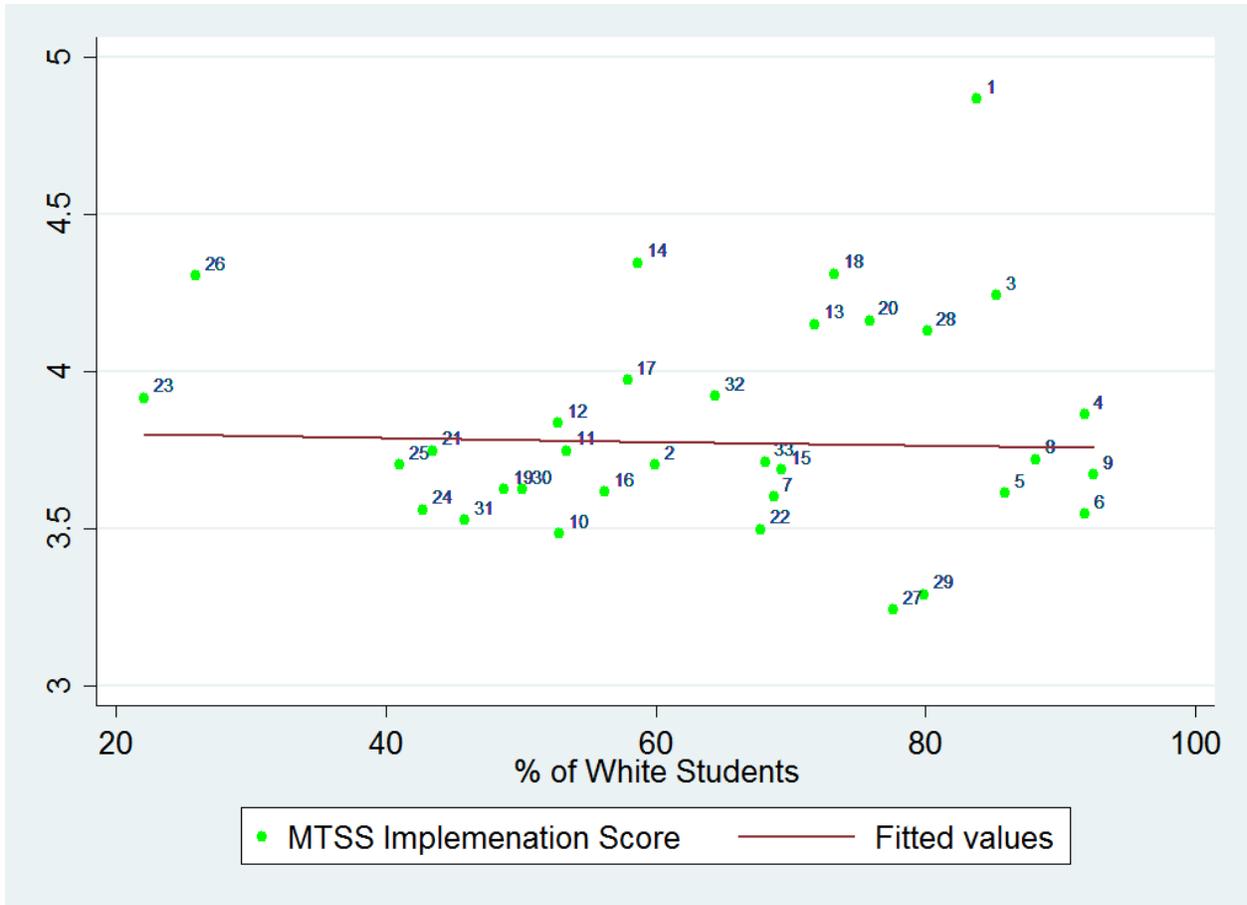


Figure 2: Percent of White Students and RTI/MTSS Implementation Rating

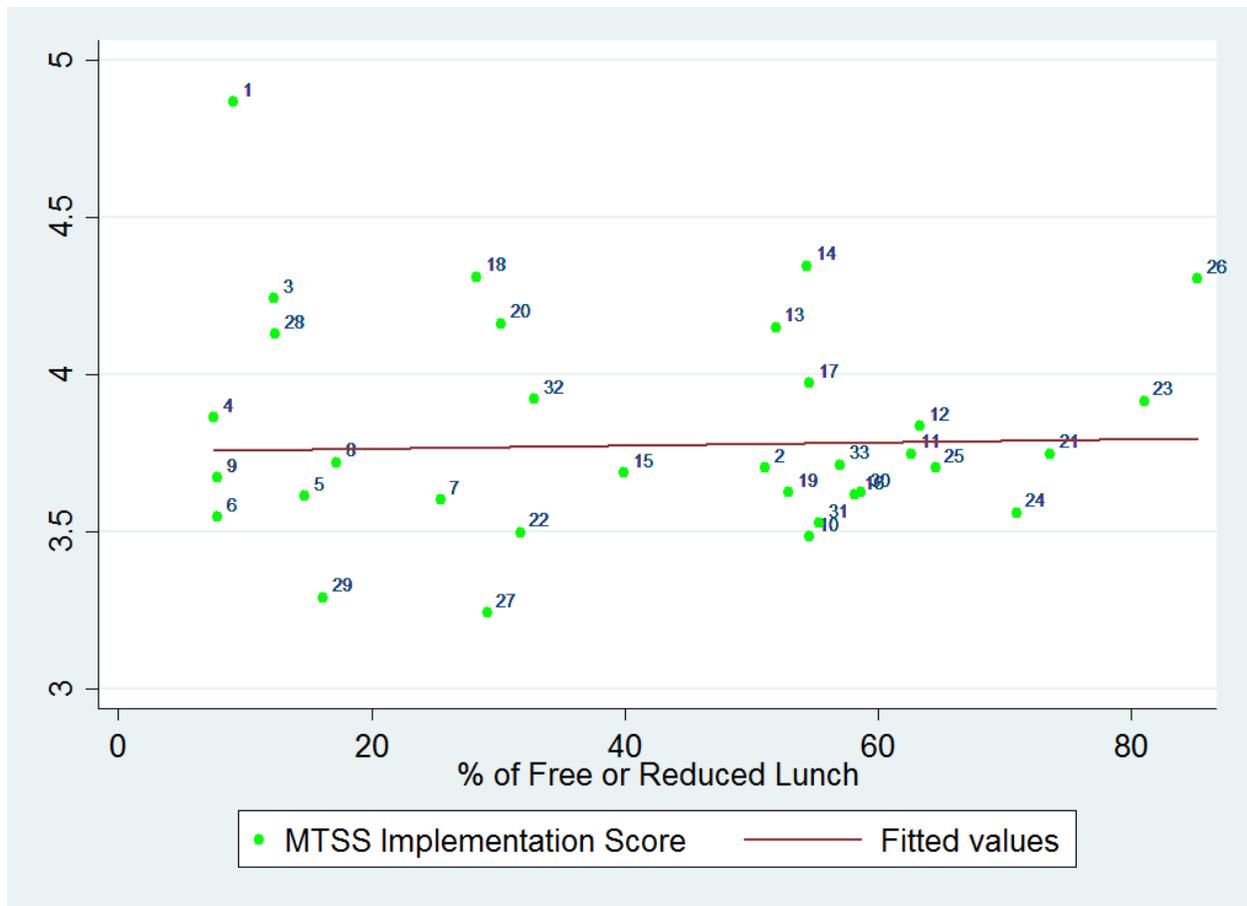


Figure 3: Percent of Students on Free/Reduced Lunch and RTI/MTSS Implementation Rating

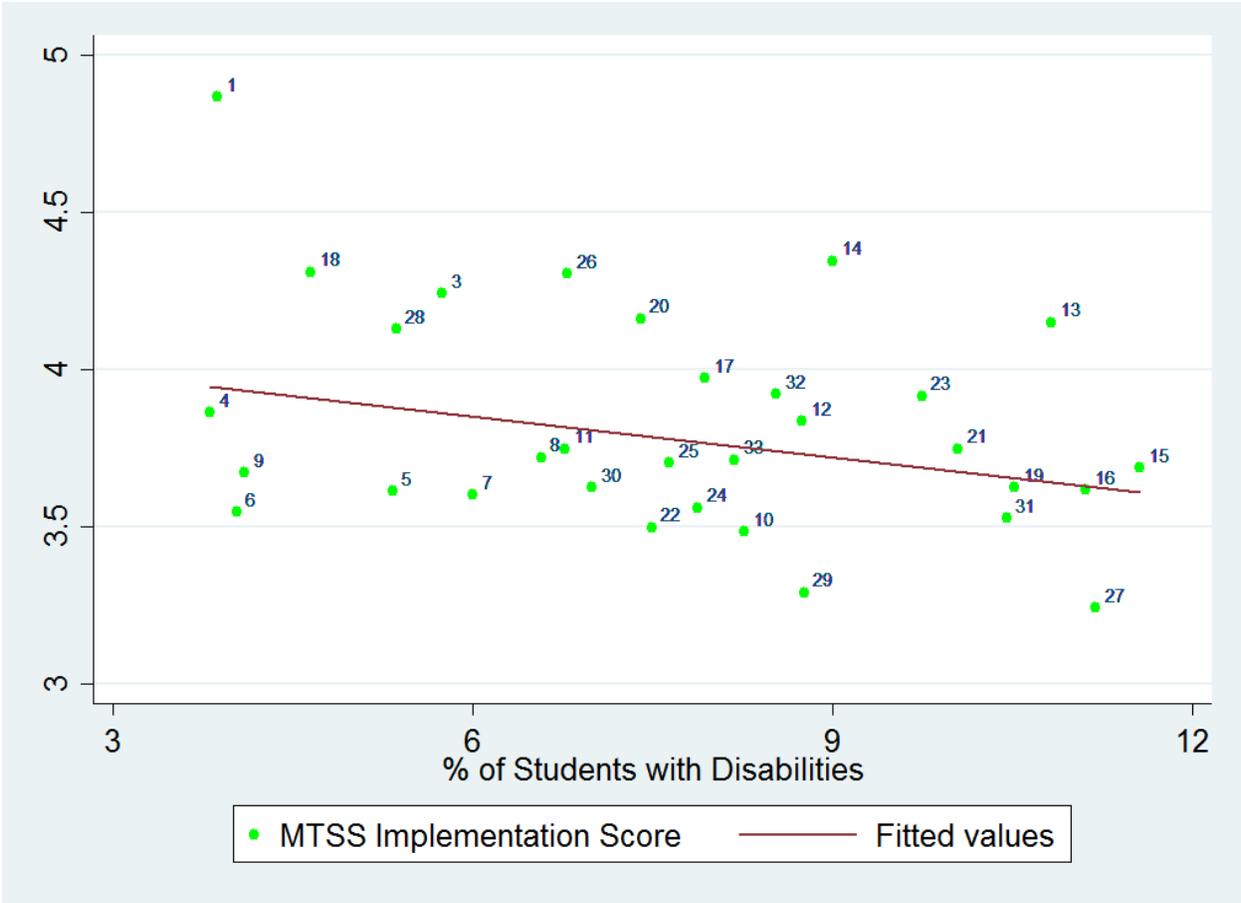


Figure 4: Percent of Students with Disabilities and RTI/MTSS Implementation Rating

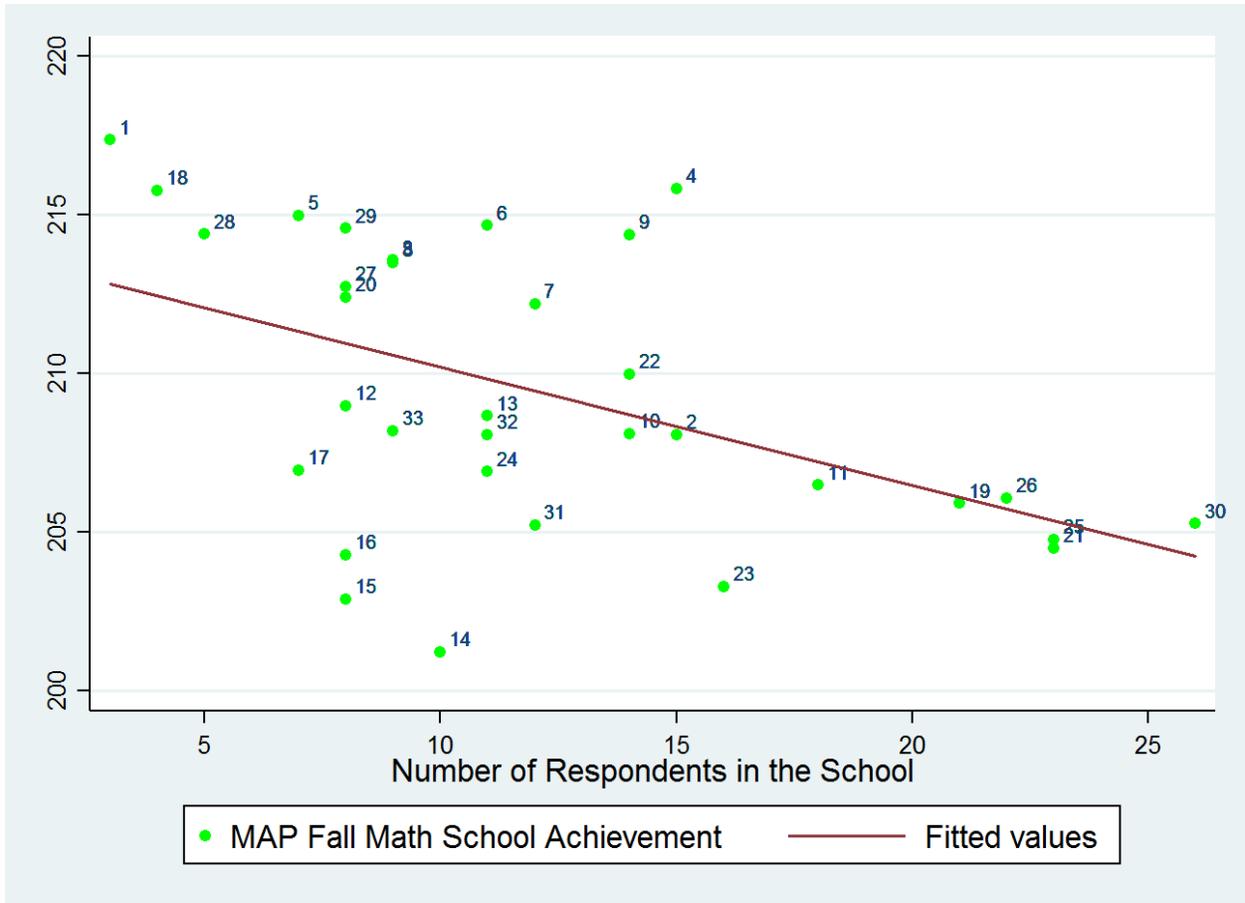


Figure 5: Mean MAP Mathematics Score and Number of Respondents per Building

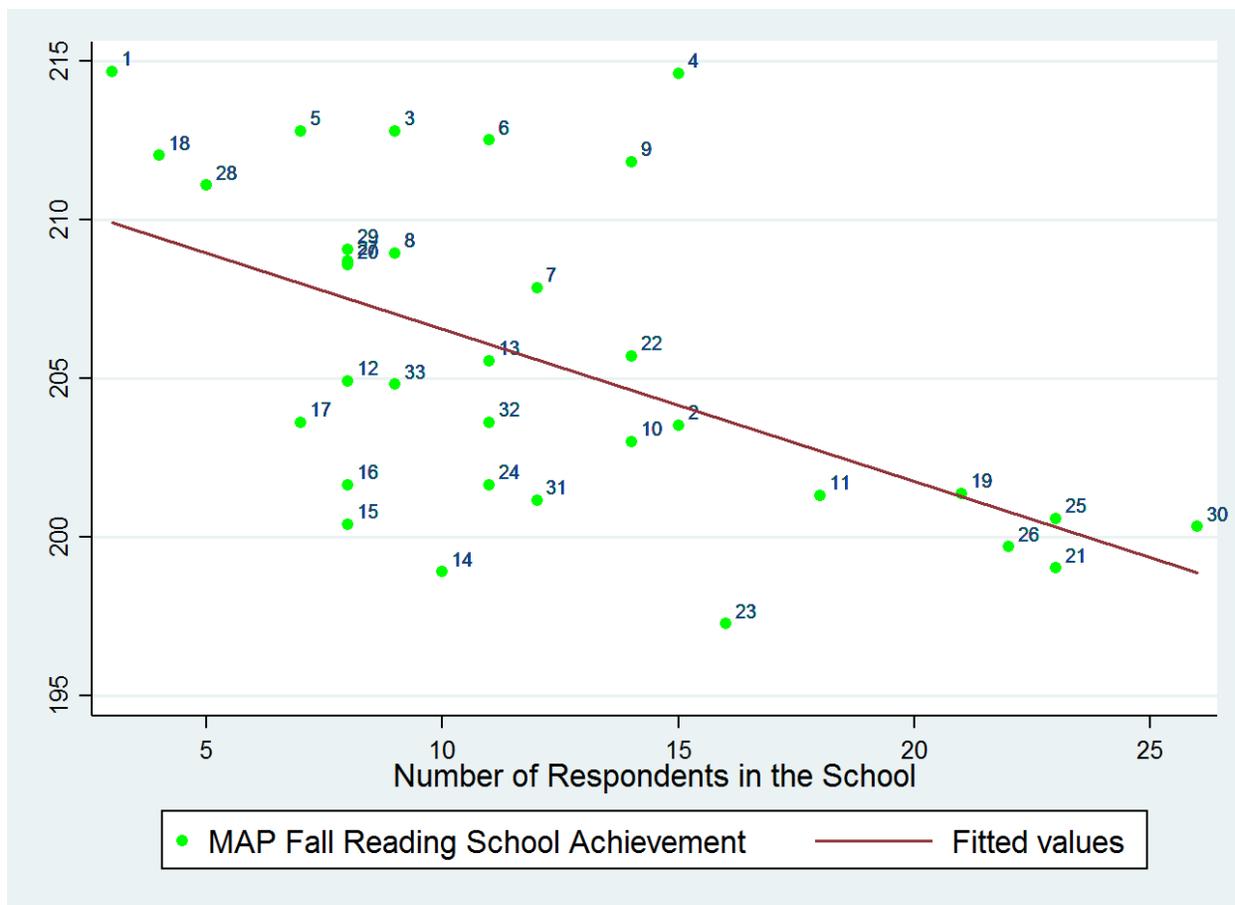


Figure 6: Mean MAP Reading Score and Number of Respondents per Building

Research Question 3: Does degree of grade-level RTI/MTSS implementation predict student achievement in reading and/or mathematics for students with and without disabilities? Grade-level differences in survey results were not statistically significant (see above) and thus are not considered in response to this research question. As indicated above, there were no statistically significant differences across grade-levels, thus precluding a meaningful answer to this question.

Research Question 4: Does degree of grade-level RTI/MTSS implementation predict student achievement in reading and/or mathematics for students with disabilities in more or less

inclusive placements? As indicated, lack of statistically significant differences across grade-levels precluded answering this question.

Research Question 5: Does degree of building level RTI/MTSS implementation predict achievement growth in mathematics and/or reading for students with and without disabilities, and for students with disabilities in more or less inclusive special education settings? Table 8 reports estimated effects of RTI/MTSS implementation on growth in mathematics achievement between the 2012-2013 and 2013-2014 school years. It includes four models, each predicting the effect of RTI/MTSS implementation on mathematics growth net of 2013 test score, with each consecutive model re-estimating the implementation effect in the context of specific controls regarding student, classroom, and school characteristics. Model 1 involves none of these controls and, as seen in the table, degree of RTI/MTSS implementation has a statistically significant negative effect on growth in mathematics achievement, with one unit of increased implementation reducing mathematics growth for the average student by -2.51 points on the MAP test beyond the difference between 2013 and 2014 test scores. This negative implementation coefficient stays relatively the same in all subsequent models regardless of the controls (i.e., -2.54, -2.62, and -2.34, respectively). However, Models 2 through 4 offer other insights about the relationship between RTI/MTSS implementation and mathematics growth in terms of student, classroom, and school effects. Specifically, in Model 2, which involves student covariates, RTI/MTSS implementation has a statistically significant negative effect on the mathematics achievement growth of Hispanic and Black students, as well as on the growth of Low SES students and students in both Special Education Setting 1 (< 21% in special education setting) and Special Education Setting 2 (21-61% in special education setting). Model 3 adds classroom variables to the student predictors. Here, the coefficients for student characteristics

remain relatively unchanged and statistically significant. In terms of classroom effects, teacher education adds positively to mathematics growth whereas teacher experience (in the district) diminishes it, and a greater proportion of female students in a classroom also had a positive effect on growth. Finally, Model 4 adds school level predictors and thus reports the full model. Previous controls remain virtually the same as in the other models and School Minority composition and Low SES composition have a statistically significant negative impact on mathematics achievement growth.

Table 9 extends Model 4 in the previous table by adding specific two-way interactions between RTI/MTSS implementation and key student level predictor variables (Race/Ethnicity, Low SES, Disability, Special Education Setting 1, and Special Education Setting 2). The first four of five models provide two-way interactions one at a time, and the fifth model introduces all the two-way interactions together. Model 4a extends the full Model 4 by adding the two-way interaction between Race/Ethnicity and RTI/MTSS implementation, and each subsequent model adds another two-way interaction term. As can be seen in the table, the results of the two-way interactions for Race/Ethnicity, Low SES, and Disability entered one at a time are no different than when all are entered together in the last model; therefore, only Model 4e is interpreted.

As seen in Model 4e, except for Race/Ethnicity, the interactions have very little effect on the student-, classroom-, and school-level coefficients in Model 4 (Table 8). The reversal of the main effect for Black (from -2.40 in Model 4 to 15.50 in Model 4e) plausibly, could be related to its contribution to the Race/Ethnicity interaction, an explanation supported by the disappearance of the reversal in Models 4b, 4c, and 4d. With regard to the Race/Ethnicity interaction itself, Model 4e shows that the negative effect of RTI/MTSS implementation on Hispanic students' mathematics growth ($-2.06 + 0.03 = -2.03$) is virtually the same as its negative effect on White

students mathematics growth (-2.06), and that the negative effect of RTI/MTSS implementation on Other ($-2.06 + (-0.54) = -2.60$) is not meaningfully different from its effect on White students. For Black students, however, one unit of RTI/MTSS implementation decreases mathematics growth more than three times as much as it decreases that of White students ($-2.06 + (-4.77) = -6.80$). The lack of statistically significant interactions for Low SES, Disability, and Special Education Setting 1 and 2 suggests that the negative effects of RTI/MTSS implementation on mathematics growth does not vary by these traits. In Model 4e, no other interaction terms gain significance aside from Black, with that interaction coefficient being roughly the same as it is in Model 4a.

In response to the research question with respect to growth in mathematics achievement, when the results are considered in the context of the full model with interactions, there is a statistically significant negative relationship between degree of RTI/MTSS implementation and growth in mathematics achievement for the average White student—one unit of RTI/MTSS implementation reduces mathematics growth by -2.06 points on MAP beyond the 2013 test score. Although growth in mathematics achievement for students from low SES backgrounds, students with disabilities, and students with disabilities in more or less inclusive special education settings was also negatively affected by degree of RTI/MTSS implementation, the negative effect was not different than that for the average student. In contrast, however, the negative effect of degree of RTI/MTSS implementation on Black students' growth in mathematics achievement was more than three times its negative effect on White students' mathematics growth.

Table 8: Mathematics Growth

Mathematics Growth	Growth Model 1		Growth Model 2		Growth Model 3		Growth Model 4	
	Coeff.	Beta	Coeff.	Beta	Coeff.	Beta	Coeff.	Beta
STUDENT								
Female			-0.28	-0.01	-0.41	-0.02	-0.40	-0.02
Hispanic			-1.29 ***	-0.05	-1.13 ***	-0.04	-1.13 ***	-0.04
Black			-2.62 ***	-0.07	-2.48 ***	-0.07	-2.40 ***	-0.07
Other			0.39	0.01	0.46	0.01	0.42	0.01
Low SES (Free-Reduced-Lunch)			-1.92 ***	-0.09	-2.02 ***	-0.10	-2.00 ***	-0.10
Disabled			1.39	0.04	1.36	0.04	1.42	0.04
Sped Setting 1			-5.08 ***	-0.12	-5.31 ***	-0.12	-5.38 ***	-0.12
Sped Setting 2			-9.36 ***	-0.12	-9.57 ***	-0.13	-9.61 ***	-0.13
CLASSROOM								
Teacher Education					1.17 ***	0.04	1.20 ***	0.04
Teacher Experience					-0.06 ***	-0.05	-0.05 ***	-0.05
Class - Female					8.11 ***	0.04	7.54 ***	0.04
Class - Minority					-1.43	-0.03	1.19	0.02
Class - Low SES					0.91	0.02	-1.75	-0.04
Class - Disabled					3.78 *	0.02	2.58	0.02
SCHOOL								
School - Minority							-9.52 ***	-0.17
School - Low SES							-7.40 ***	-0.17
School - Disabled							13.15	0.03
2013 Test Score	-0.16 ***	-0.24	-0.20 ***	-0.31	-0.20 ***	-0.31	-0.20 ***	-0.31
Implementation	-2.51 ***	-0.08	-2.54 ***	-0.08	-2.62 ***	-0.08	-2.34 ***	-0.07
Constant	53.35 ***		64.60 ***		59.19 ***		64.76 ***	
F - Prob	0.00		0.00		0.00		0.00	
R ²	0.07		0.10		0.11		0.11	

***Significant at 1%

**Significant at 5%

*Significant at 10%

Table 9: Mathematics Growth with Interactions

Mathematics Interactions	Interaction Model 4a		Interaction Model 4b		Interaction Model 4c		Interaction Model 4d		Interaction Model 4e	
	Coeff.	Beta								
STUDENT										
Female	-0.41	-0.02	-0.40	-0.02	-0.40	-0.02	-0.41	-0	-0.41	-0.02
Hispanic	-1.28	-0.05	-1.12 ***	-0.04	-1.13 ***	-0.04	-1.13 ***	-0.04	-1.04	-0.04
Black	15.12 **	0.42	-2.41 ***	-0.07	-2.40 ***	-0.07	-2.40 ***	-0.07	15.50 **	0.43
Other	2.47	0.07	0.41	0.01	0.42	0.01	0.43	0.01	2.46	0.07
Low SES (Free-Reduced-Lunch)	-2.01 ***	-0.10	0.11	0.01	-2.00 ***	-0.10	-2.00 ***	-0.10	-2.10	-0.10
Disability	1.44	0.04	1.41	0.04	0.79	0.02	1.44	0.04	35.75	0.94
Sped Setting 1	-5.39 ***	-0.12	-5.37 ***	-0.12	-5.38 ***	-0.12	-10.84	-0.25	-45.47 *	-1.03
Sped Setting 2	-9.66 ***	-0.13	-9.60 ***	-0.13	-9.61 ***	-0.13	-5.15	-0.07	-40.51	-0.53
CLASSROOM										
Teacher Education	1.22 ***	0.04	1.19 ***	0.04	1.20 ***	0.04	1.20 ***	0.04	1.21 ***	0.04
Teacher Experience	-0.05 ***	-0.04	-0.05 ***	-0.05	-0.05 ***	-0.05	-0.05 ***	-0.05	-0.05 ***	-0.04
Class - Female	7.19 ***	0.04	7.38 ***	0.04	7.54 ***	0.04	7.53 ***	0.04	7.15 ***	0.04
Class - Minority	1.20	0.02	1.19	0.02	1.19	0.02	1.18	0.02	1.14	0.02
Class - Low SES	-1.80	-0.04	-1.75	-0.04	-1.75	-0.04	-1.74	-0.04	-1.76	-0.04
Class - Disabled	2.56	0.02	2.54	0.02	2.58	0.02	2.50	0.02	2.47	0.02
SCHOOL										
School - Minority	-9.76 ***	-0.17	-9.58 ***	-0.17	-9.51 ***	-0.17	-9.54 ***	-0.17	-9.79 ***	-0.17
School - Low SES	-7.77 ***	-0.18	-7.50 ***	-0.17	-7.39 ***	-0.17	-7.39 ***	-0.17	-7.80 ***	-0.18
School - Disabled	12.17	0.03	12.95	0.03	13.17	0.03	13.41	0.03	12.37	0.03
2013 Test Score	-0.20 ***	-0.31	-0.20 ***	-0.31	-0.20 ***	-0.31	-0.20 ***	-0.3	-0.20 ***	-0.31
Implementation	-2.03 ***	-0.06	-2.16 ***	-0.07	-2.35 ***	-0.07	-2.39 ***	-0.1	-2.06 ***	-0.06
INTERACTIONS										
Race/Ethnicity x Implementation										
Hispanic	0.03	0.00							-0.03	0.00
Black	-4.67 ***	-0.48							-4.77 **	-0.49
Other	-0.54	-0.06							-0.54	-0.06
Low SES x Implementation										
			-0.56	-0.10					0.02	0.00
Disability x Implementation										
					0.17	0.07			-9.15	-0.91
Sped Setting x Implementation										
Sped Setting 1							1.45	0.12	10.68	0.92
Sped Setting 2							-1.19	-0.06	8.24	0.41
Constant	64.02 ***		64.25 ***		64.79 ***		64.89 ***		64.17 ***	
F - Prob	0.00		0.00		0.00		0.00		0.00	
R ²	0.11		0.11		0.11		0.11		0.11	

***Significant at 1%
 **Significant at 5%
 *Significant at 10%

In terms of reading performance, Table 10 reports estimated effects of degree of RTI/MTSS implementation on growth in reading achievement from 2013 to 2014. It includes four models, each of which predicts the effect of degree of RTI/MTSS implementation on growth in reading achievement, net of 2013 test score, with each consecutive model re-estimating the implementation effect in the context of specific controls for student, classroom, and school characteristics. Model 1 does not involve any of these controls and, as seen in the table, degree of RTI/MTSS implementation has a statistically significant negative effect on

growth in reading achievement, with one unit increase in degree of implementation reducing reading growth for the average student by -1.04 points on the MAP reading test. This negative degree of implementation coefficient remains relatively the same and stays statistically significant in all subsequent models regardless of the controls (-1.00, -0.95, and -1.00, respectively). Model 2, which adds student covariates, indicates degree of RTI/MTSS implementation has a statistically significant negative effect for Hispanic Students, Black students, Low SES students, and students with disabilities in the least inclusive Special Education Setting 2 (21-61% in special education setting). Model 3 adds classroom variables to the student predictors, the coefficients for which remain relatively unchanged and statistically significant. Each of the predictor variables considered at the classroom level are statistically significant, with negative effects for teacher experience and low SES classroom composition and positive effects for all other variables. Model 4 adds school level predictors and thus the full model is reported. Coefficients for previous controls remain similar to the other models; however, Low SES classroom composition no longer remains statistically significant. None of the school composition variables (Minority, Low SES, or Disabled) were statistically significant.

Table 11 extends Model 4 by adding specific two-way interactions between degree of RTI/MTSS implementation and key student level predictor variables (Race/Ethnicity, Low SES, Disability, and Special Education Setting) one at a time until Model 4e, where they are all included simultaneously. The reading growth results are somewhat different and less straightforward than those for mathematics growth. Although the main effect for degree of implementation retains its negative direction from Model 4 (Table 10), it loses statistical significance in some models, which suggests that overall the interactions are not contributing significantly to the negative effect of implementation on reading growth. With regard to specific

two-way interactions with degree of RTI/MTSS implementation, Model 4a and Model 4d show statistically significant interactions, respectively, between degree of implementation and Black (negative) within the Race/Ethnicity interaction term and the less inclusive Special Education Setting 2 (positive) within the Special Education Setting interaction term. However, when the interaction terms are added simultaneously in Model 4e, the only interaction that remains statistically significant is the negative coefficient for Black students. For every one unit increase in degree of RTI/MTSS implementation, growth in reading achievement for the average Black student decreased by -3.11 points on the MAP reading test, which is more than six times its negative effect for White students' growth ($-0.59 + (-3.11) = -3.70/-0.59 = 6.27$). Moreover, the statistical non-significance of degree of implementation in Model 4e suggests that the statistically significant negative main effect of implementation on reading growth in Model 4 (Table 7) is due largely to its effect on Black students.

In response to the fifth research question relative to reading growth, degree of RTI/MTSS implementation has no effect on the average White student's reading growth, but a highly negative effect on that of Black students. It has no effect on Low SES students and on students with disabilities in either resource room or pull-out settings. That is, when the results are considered within the context of the full model with interactions, there is no statistically significant relationship between students with disabilities in either of the two special education settings and RTI/MTSS implementation on reading achievement growth.

Table 10: Reading Growth

Reading Growth	Growth Model 1		Growth Model 2		Growth Model 3		Growth Model 4	
	Coeff.	Beta	Coeff.	Beta	Coeff.	Beta	Coeff.	Beta
STUDENT								
Female			0.14	0.01	0.04	0.00	0.04	0.00
Hispanic			-0.88 ***	-0.04	-1.07 ***	-0.05	-1.07 ***	-0.05
Black			-2.47 ***	-0.08	-2.72 ***	-0.08	-2.72 ***	-0.08
Other			-0.01	0.00	-0.21	-0.01	-0.20	-0.01
Low SES (Free-Reduced-Lunch)			-1.69 ***	-0.09	-1.41 ***	-0.08	-1.43 ***	-0.08
Disabled			-1.19	-0.03	-1.33	-0.04	-1.39	-0.04
Sped Setting 1			-1.08	-0.03	-1.19	-0.03	-1.11	-0.03
Sped Setting 2			-7.65 ***	-0.11	-7.92 ***	-0.12	-7.85 ***	-0.11
CLASSROOM								
Teacher Education					0.78 **	0.03	0.70 **	0.03
Teacher Experience					-0.04 ***	-0.04	-0.04 ***	-0.04
Class - Female					6.68 ***	0.04	6.68 ***	0.04
Class - Minority					4.02 ***	0.09	4.35 ***	0.10
Class - Low SES					-3.89 ***	-0.10	-1.32	-0.04
Class - Disabled					4.92 ***	0.04	5.81 ***	0.04
SCHOOL								
School - Minority							0.71	0.01
School - Low SES							3.63	0.09
School - Disabled							-3.31	-0.01
2013 Test Score	-0.20 ***	-0.36	-0.26 ***	-0.45	-0.26 ***	-0.45	-0.26 ***	-0.45
Implementation	-1.04 ***	-0.04	-1.00 ***	-0.03	-0.95 ***	-0.03	-1.00 ***	-0.03
Constant	52.91 ***		64.54 ***		60.34 ***		57.46 ***	
F - Prob	0.00		0.00		0.00		0.00	
R ²	0.13		0.17		0.17		0.17	

***Significant at 1%
 **Significant at 5%
 *Significant at 10%

Table 11: Reading Growth with Interactions

Reading Interactions	Interaction Model 4a		Interaction Model 4b		Interaction Model 4c		Interaction Model 4d		Interaction Model 4e	
	Coeff.	Beta								
STUDENT										
Female	0.03	0.00	0.05	0.00	0.04	-0.02	0.05	0.00	0.04	0.00
Hispanic	0.60	0.03	-1.06 ***	-0.04	-1.07 ***	-0.01	-1.08 ***	-0.05	-1.48	-0.06
Black	10.72 *	0.33	-2.74 ***	-0.08	-2.72 ***	-0.07	-2.71 ***	-0.08	8.93	0.27
Other	-0.89	-0.03	-0.22	-0.01	-0.19	0.00	-0.20	-0.01	-1.79	-0.06
Low SES (Free-Reduced-Lunch)	-1.43 ***	-0.08	3.76	0.20	-1.42 ***	-0.03	-1.42 ***	-0.08	3.10	0.17
Disability	-1.37	-0.04	-1.44	-0.04	-5.91	-0.31	-1.51	-0.04	1.85	0.05
Sped Setting 1	-1.12	-0.03	-1.08	-0.03	-1.11	0.02	-1.01	-0.03	-5.60	-0.14
Sped Setting 2	-7.89 ***	-0.11	-7.81 ***	-0.11	-7.86 ***	-0.06	-31.77 ***	-0.46	-37.57	-0.55
CLASSROOM										
Teacher Education	0.71 **	0.03	0.69 **	0.03	0.69 **	0.02	0.68 **	0.03	0.69 **	0.03
Teacher Experience	-0.04 ***	-0.04	-0.04 ***	-0.04	-0.04 ***	-0.04	-0.04 ***	-0.04	-0.04 ***	-0.04
Class - Female	6.35 ***	0.04	6.24 ***	0.04	6.70 ***	0.02	6.74 ***	0.04	6.18 ***	0.04
Class - Minority	4.33 ***	0.10	4.35 ***	0.10	4.34 ***	0.09	4.30 ***	0.09	4.28 ***	0.09
Class - Low SES	-1.34	-0.04	-1.34	-0.04	-1.30	-0.04	-1.29	-0.03	-1.33	-0.04
Class - Disabled	5.81 ***	0.04	5.72 ***	0.04	5.77 ***	0.03	5.91 ***	0.04	5.84 ***	0.04
SCHOOL										
School - Minority	0.59	0.01	0.54	0.01	0.79	-0.02	0.98	0.02	0.78	0.02
School - Low SES	3.36	-0.08	3.33	-0.08	3.71 *	-0.02	3.81 *	-0.10	3.39	-0.08
School - Disabled	-4.20	-0.01	-3.72	-0.01	-3.19	0.00	-3.61	-0.01	-4.58	-0.01
2013 Test Score Implementation	-0.26 ***	-0.45	-0.26 ***	-0.45	-0.26 ***	-0.24	-0.26 ***	-0.45	-0.26 ***	-0.45
	-0.74 *	-0.03	-0.56	-0.02	-1.07 ***	-0.04	-1.08 ***	-0.04	-0.59	-0.02
INTERACTIONS										
Race/Ethnicity x Implementation										
Hispanic	-0.44	-0.07							0.11	0.02
Black	-3.58 **	-0.41							-3.11 **	-0.36
Other	0.19	0.02							0.42	0.05
Low SES x Implementation										
			-1.37 *	-0.28					-1.20	-0.25
Disability x Implementation										
					1.20	0.44			-0.90	-0.10
Sped Setting x Implementation										
Sped Setting 1							-0.002	0.00	1.23	0.12
Sped Setting 2							6.37 **	0.35	7.92	0.43
Constant	56.77 ***		56.22 ***		57.62 ***		57.59 ***		56.21 ***	
F - Prob	0.00		0.00		0.00		0.00		0.00	
R ²	0.17		0.17		0.17		0.17		0.18	

***Significant at 1%

**Significant at 5%

*Significant at 10%

Overall, results indicate that when estimating growth from one year to the next, degree of RTI/MTSS implementation has a negative effect on mathematics achievement growth for the average student, and especially for Black students. However, for reading achievement growth, the negative effect of implementation was not significant for White students and highly significant for Black students.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

Almost since the inception of public education, the performance of our nation's schools has been called into question. Not only have the academic performance outcomes for schools in general been criticized, but also the outcomes for special populations of students, particularly students with disabilities, racial/ethnic minority students, and students living in poverty. Although it started narrowly as a practice for improving reading instruction and with the identification of students with learning disabilities, Response to Intervention/Multi-Tiered Systems of Support (RTI/MTSS), has been expanded and applied to whole school reform (Jimerson et al., 2007). With this broader application of RTI/MTSS, two types of research are needed but have been lacking. First, research on the effectiveness of RTI/MTSS with regard to the academic performance of all students in a school or district, including the performance of special populations. Second, research on its effects as an integrated school improvement system (Deshler, 2015). The present research is an attempt to help fill this gap by addressing both needs in a single study. The chapter is organized into three sections: discussion of findings (including limitations), conclusions and recommendations, and recommendations for future research.

Discussion of Findings

The focus of the present study was the effects of degree of implementation of RTI/MTSS as an integrated school improvement system on growth in mathematics and reading achievement for all students in the 33 elementary schools of a metropolitan school district, focusing primarily on achievement growth of students with disabilities, and secondarily on that of racial/ethnic minority students and students living in poverty. In addition, for students with disabilities, inclusiveness of special education placement was considered, including primarily regular

classroom placement, defined as spending less than 21% of the school day in a special education setting, and primarily pull-out or resource room placement, defined as spending 21-61% in a special education setting. The design of the study attempted to overcome limitations of previous research by (a) considering implementation of RTI/MTSS as an integrated set of practices rather than evaluating individual components, (b) providing multiple years of data to allow for an achievement growth score, (c) using a measure of RTI/MTSS implementation that allows for differentiating degree of implementation across schools, (d) surveying school instructional staff and principals rather than simply building leadership teams or RTI/MTSS trainers, and (e) collecting and analyzing implementation and achievement data from all 33 elementary schools a metropolitan district's self-initiated and designed RTI/MTSS model. The study's findings are discussed below relative to the remaining research questions, i.e., after dropping questions 3 and 4 related to grade-level differences, questions 1, 2, and 5. First, however, research limitations are addressed.

The study is limited primarily by the fact that the modified RTI/MTSS implementation survey was not sensitive enough to detect grade-level implementation differences. Had a more sensitive instrument been used, differences across grade levels within and across schools, if detected, may have provided additional insight into implementation effects, especially within school buildings since grade-level teaming is likely to have been more consequential for achievement growth than school-level collaboration. Differences in implementation may also have been detected between lower and upper elementary grades in light of the prevention orientation of RTI/MTSS.

Research Question 1

This question asked whether there were differences in degree of building-level and grade-level RTI/MTSS implementation. Although there were differences in degree of implementation across buildings, there were none between grade levels. Given that RTI/MTSS was implemented over three academic years with different cohorts of schools, the primary consideration in this regard was whether degree of building-level implementation varied by cohort. Implementation differences between two of the three cohorts were detected, they were too small to conduct a cohort-level analysis. Although detecting cohort differences was beyond the capacity of the present study, they cannot be ruled out. The lack of clear results related to this research question underscores the difficulty in measuring change in complex and nested systems such as schools within a school district. The present study attempted to evaluate the effects of RTI/MTSS implementation as an integrated set of practices in the context of schools with particular student, classroom, and compositional characteristics. Although this level of complexity inherently presents even more challenges, it also provides a broader, more systemic understanding of the practices being implemented in context. This is important because, as Supovitz and Taylor (2005) noted:

[E]ducation program evaluators (much like their kin in other fields) have repeatedly observed more complex and variable effects; Program X does not regularly produce Effect Y but rather produces different outcomes in different contexts. The program is not the causal mechanism. Rather, the program interacts with elements of the environment to produce different effects. (p. 208)

Research Question 2

This question asked how school characteristics affect degree of school and grade-level RTI/MTSS implementation. Dropping the grade-level consideration and focusing on the effect of school characteristics, degree of school-level RTI/MTSS implementation did not vary on the

basis of schools' racial/ethnic or low SES composition, but did vary with respect to disability composition, with lower degrees of RTI/MTSS implementation in schools that had higher percentages of students with disabilities. Perhaps this is related to the effects of degree of RTI/MTSS implementation on the identification of students with disabilities. That is, it could be that schools with higher degrees of RTI/MTSS implementation conduct fewer evaluations, therefore identifying fewer students as having disabilities, which is consistent with the findings of VanDerHeyden et al. (2007) in this regard. However, a more troubling interpretation of this finding, especially in light of findings below indicating that degree of RTI/MTSS implementation had no effect on reading achievement growth of students with disabilities and a negative effect on their mathematics achievement growth (see Research Question 5 below), is that RTI/MTSS implementation in this district under-identifies students with disabilities who need special educational and related services to achieve adequately in reading and mathematics.

Research Question 5

This question asked whether degree of building-level RTI/MTSS implementation predicts achievement growth in mathematics and/or reading for students with and without disabilities, and for students with disabilities in more or less inclusive special education settings. Consistent with the findings of the large-scale Institute of Education Sciences study that early elementary students' reading achievement was negatively affected by receiving tiered-intervention supports (Balu, Zhu, Doolittle, Schiller, Jenkins, & Gersten, 2015), the present study also found that exposure to a greater degree of RTI/MTSS implementation negatively affected achievement growth in mathematics for the average student and especially for Black students compared to White ones, and that, while degree of implementation had no effect on the average students' growth in reading, including those with disabilities, it had an especially negative effect on that of

Black students compared to White students. Moreover, the present research also extended the Balu et al. findings in several ways. First, it extended the finding of a negative effect of RTI/MTSS in early elementary reading achievement by demonstrating the same negative effect for achievement *growth* in reading for Blacks *and* in mathematics for all students in *all elementary grades*, first through sixth, especially for Black students. Second, the present research extended Balu et al.'s negative-effect finding by correlating negative effects for mathematics and reading growth to *degree* of RTI/MTSS implementation across schools. Third, the present research extended their negative-effect finding from the school level to the *district or systems level* by analyzing implementation and achievement data from all 33 elementary schools of a metropolitan school district. An advantage of the Balu et al. study is its regression discontinuity design, which permits the authors to infer that exposure to tiered-intervention supports *caused* losses in reading achievement in early elementary grades. Given its design, the present study only demonstrates a correlation between degree of RTI/MTSS implementation and decreases in growth of academic achievement for all students and in reading for Black students. Nonetheless, its findings are significant in that they support and extend Balu et al.'s quasi-experimental findings regarding the negative effects of tiered-intervention supports.

However, given the present study's correlational design, an important caveat is in order. With such a design, there is no way to determine decisively whether degree of RTI/MTSS implementation has a negative effect on student achievement, or whether degree of implementation is biased toward more academically needy students. This is especially important to consider for all students with regard to growth in mathematics achievement, including students with disabilities, and especially for African American students in mathematics and reading achievement growth, given that school buildings with greater degrees of RTI/MTSS

implementation had more negative achievement gains for these student groups in mathematics and reading gains, respectively.

Conclusions and Recommendations for Future Research

The findings of the current study indicate that, for the average student, degree of RTI/MTSS implementation negatively affected growth in mathematics achievement and had no effect on growth in reading achievement. For Black students, however, the negative effect on mathematics and reading growth was significantly more than for the average student and for White students, respectively. The negative effect of degree of RTI/MTSS implementation on students with disabilities' growth in mathematics achievement in both the more and less inclusive special education settings did not vary from its negative effect for the typical student. Although the same is true for growth in reading achievement for students with disabilities in the less inclusive setting, the negative effect of degree of RTI/MTSS implementation on students with disabilities were eliminated in the full regression model, indicating that, as for the typical student, degree of RTI/MTSS implementation had no effect on students with disabilities' growth in reading achievement.

The effects of classroom- and school-level variables were parallel in some respects and different in others relative to growth in mathematics and reading achievement. They were parallel in that, for both mathematics and reading growth, teacher education had a positive effect, while teacher experience had a negative one. The positive effects of teacher education are contrary to previous research indicating that advanced degrees are not correlated with improved student performance (Chingos & Peterson, 2011; Hanushek, 2011). However, the finding that teacher experience negatively affected growth in mathematics and reading achievement is consistent with research showing that, while some experience is better than none, there is a

diminishing marginal return to the effects of teacher experience on reading and mathematics achievement beyond the first few years (Boyd, Lankford, Loeb, Rockoff, & Wyckoff, 2007; Rice, 2010).

In terms of classroom composition variables, reading and mathematics achievement growth were both positively affected by larger proportions of female students in the classroom, and reading achievement growth was positively affected by larger proportions racial/ethnic minority students and students with disabilities. The finding that reading and mathematics achievement growth were both positively affected by a greater proportion of female students is consistent with current research demonstrating this effect in both subject areas (Hoxby, 2000; Loveless, 2015). However, the finding that larger proportions racial/ethnic minority students positively affects growth in reading achievement is inconsistent with current research showing that students from all racial/ethnic groups tend to achieve worse in reading and mathematics in classrooms with a larger proportions of African American students (Hanushek, Kain, & Rivkin, 2009; Hoxby, 2000). Perhaps the present contrary finding suggests a positive contribution of RTI/MTSS implementation in this regard. Finally, although there continues to be conflicting research findings on the effects of inclusion of students with and without disabilities, the present finding that reading achievement growth was positively affected by larger proportions of students with disabilities in the classroom supports other research showing evidence of positive overall effects of inclusive education on the achievement of students with and without disabilities (McLeskey, Waldron, Spooner & Algozzine, 2014; Sailor, 2016).

At the school level, mathematics achievement growth was negatively affected by degree of RTI/MTSS implementation in schools with greater proportions of racial/ethnic minority students and of low SES students. This finding is consistent with research demonstrating that

persistent achievement differences between White middle-class students and poor and/or racial/ethnic minority students stem largely from lesser quality schools serving the communities of the latter students (Owens, Reardon, & Jencks, 2016), as well as non-school factors associated with these communities themselves, such as residential isolation and social disorganization (Barton & Coley, 2010). The fact that schools with greater proportions of racial/ethnic minority students and low SES students negatively affected growth in mathematics achievement but not growth in reading achievement, is consistent with research showing that acquisition of mathematics skills is more school-dependent than reading skills, which in comparison are more home- and community-dependent (Bryk, Lee, & Holland, 1993).

The findings that degree of RTI/MTSS implementation (a) reduces all students' growth in mathematics achievement, including those with disabilities, while reducing Black students' growth significantly more than the typical student, and that (b) it has no effect on the average students' growth in reading, while reducing Black students' reading growth five times as much as White students, raise serious questions about the utility of RTI/MTSS as a mechanism for achieving the laudable NCLB, ESSA (Every Student Succeeds Act), and IDEA goals of improving the academic performance of all students and reducing the achievement gap between White middle class nondisabled students and poor and/or racial/ethnic minority students and students with disabilities. Historically, well-meaning attempts to improve and equalize education through standardization merely have made schools more bureaucratic, which by reducing teachers' discretion makes them less able to adapt their practices to a diversity of student needs (Skrtic, 1995). Many researchers, policymakers, educators, and equity advocates have tied their reform prospects to the idea of RTI/MTSS being a different, more comprehensive and systemic kind of reform. Currently, it is "one of the most widespread [non-mandated]

innovations to occur in education in the last century, with implementation sites in all 50 states” (VanDerHeyden & Tilly, 2010, p. 2). With findings like Balu et al.’s (2015) and those reported here, however, RTI/MTSS may be becoming, in VanDerHeyden and Tilly’s words, “vulnerable to the same misuse and subsequent abandonment that has plagued generations of educational innovations” (p. 2).

Unfortunately, the negative effects of RTI/MTSS implementation on African American students in the current study are not unique in the education reform literature, whether the reform is NCLB (Berliner, 2011) or IDEA (Kozleski & Huber, 2010). In an effort to understand factors influencing such racial disparities, Noguera (2008) studied two school districts attempting to improve the performance of their racial/ethnic minority students. The district in which African American and Latino/a students made the most growth demonstrated a higher level of commitment and self-efficacy in ameliorating the disparities, while the other school district largely spent its energy blaming the victims. He concluded: “Districts and communities that confront the challenge of racial disparities directly, with a clearly articulated and fully funded strategy, are more likely to experience tangible gains for their students” (p. 100). Without the necessary will and human and fiscal capacity, it is unlikely that any school reform model, even a comprehensive, systemic one like RTI/MTSS, can overcome achievement gaps. Moreover, even if schools could be improved in this regard, that would be only half the battle. Eliminating the achievement gap between White middle-class and poor and racial/ethnic minority students also requires the will and funding to reduce the *community* gap, the non-school factors that affect the achievement of these students as much or more than the schools they attend.

Clearly, more research is needed to explain the negative effects on achievement found in this study and in Balu et al. (2015) regarding implementing RTI/MTSS as an integrated school

improvement model at the school and district level. Given demonstrated positive effects of separate elements of RTI/MTSS on student learning (e.g., Adeleman & Taylor, 1998; Fuchs et al., 1994), perhaps the problem is associated with some aspect of going to scale with the model. In this regard, qualitative studies of teachers' capacity for and commitment to implementing the model would be helpful. Although less of an issue in small-scale, single-component studies, implementing RTI/MTSS as an integrated system requires greater capacity, while commitment is likely to decrease as one moves from small groups of dedicated and/or closely monitored implementers to an entire building or district faculty.

Another recommendation is more implementation research focused specifically on potential differential effects of RTI/MTSS implementation at the grade level within schools. Although such an analysis was planned in the present study, measurement issues prevented it. Given that the necessary child-centered collaboration is more likely at the grade level than the school level, and that the prevention orientation of RTI/MTSS implicates early grades more than later ones, observation of grade-level implementation would have allowed for differentiation of early- and late-grade implementation effects on achievement growth. Future research should focus specifically on the effects of RTI/MTSS implementation on student learning at the grade level within schools. Quantitative and qualitative insights at this level may be key to understanding implementation effects at the school level. This study also underscores the necessity of objective documentation of the implementation of critical components of RTI/MTSS in order to fully assess its effects on academic achievement and other important school and grade-level outcomes.

Finally, and ironically, perhaps we need to make school improvement even more complicated by enlisting RTI, and especially MTSS, in the "community gap" problem noted

above. Here, future research and development should test and advance Averill and Rinaldi's (2011) broader conception of MTSS. If we think of RTI as a model for educational decision making in schools, MTSS provides the overall organizational framework of "structures ... that provide a continuum of support for removing the systemic challenges and barriers that hinder students' success" (p. 2). And in their broadest sense, such structures:

activate home-school-community relationships and bring together partners from the education, mental health, family, social service, medical, juvenile justice, recreation, and cultural domains within the multi-tier system. These collaborations, together with educational leadership at the district and school level, promote the formation of wraparound structures, supports, and practices to help students succeed in school. (p. 2)

Regardless of reform model, school improvement is necessary but not sufficient to make education both excellent and equitable for all children and families. Improving school outcomes and eliminating the long-standing achievement gap between majority and marginalized students—poor and working class students, racial/ethnic and cultural/linguistic minority students, and students with disabilities—also requires a way to address social inequities in communities. Research advancing Averill and Rinaldi's broader conception of RTI/MTSS would be an important contribution to removing systemic non-school, community challenges and barriers that hinder students' success in school.

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Appendix A

School Implementation Scale (Gaumer-Erickson et al., 2012)

Survey Questions

1. Choose your role:
 - Teacher
 - Administrator
2. How many years have you been at your current school?
3. What is your highest level of education?
4. Are you a member of the MTSS building leadership team?
 - No, our school does not have a MTSS leadership team.
 - No, I am not involved with the MTSS building leadership team.
 - No, but I have attended MTSS building leadership team meetings.
 - Yes, but I rarely/never attend MTSS building leadership team meetings.
 - Yes, I am actively involved with the MTSS building leadership team meetings.
5. Are you currently highly qualified in your job assignment?

Please rate each item:

1. Not at all true of me now.
 - 2.
 3. Somewhat true of me now.
 - 4.
 5. Very true of me now.
-
1. I can summarize my school's shared vision/mission
 2. I have a clear understanding of the phrase "tiered levels of academic and behavior support."
 3. I am involved in meetings where data results are discussed and problem solving occurs.
 4. I am involved in action planning tiered supports with the other staff and administrators at my school.
 5. I collaborate with my colleagues on a regular basis.
 6. I have the time necessary to analyze student data and problem solve with my colleagues.
 7. I have the technology and resources that I need to provide effective instruction.
 8. I think my school has an effective process in place to identify available resources (e.g., materials, technology, people).
 9. I feel that my administrators are committed to implementing tiered levels of academic supports.
 10. I feel that my administrators are committed to implementing tiered levels of behavior supports.
 11. I think my school is a good place to work.
 12. I think that MTSS is improving education for students in my school.
 13. I participate in professional development where I learn how to monitor students' progress and use progress monitoring data.
 14. I receive coaching/mentoring to implement evidence-based instructional practices.

15. I receive coaching mentoring to help me implement tiered levels of academic support.
16. I receive coaching/mentoring to help me implement tiered levels of behavior support.
17. I regularly communicate with families regarding student academic goals/progress.
18. I regularly communicate with families regarding student behavior goals/progress.
19. I make informed decisions based on feedback from families.
20. I think my school does a good job in including parents as team members in data-based decision-making.
21. I am able to meet the students' diverse needs.
22. I consider my students' backgrounds when I teach and/or interact with students.
23. I receive school-wide academic and behavior data in usable and understandable formats.
24. I think my school does a good job of addressing the academic needs of students at tier 1 (universal).
25. I think my school does a good job of addressing the behavior needs of 1.
26. I use assessment data at least three times a year to monitor students' progress.
27. I evaluate the effectiveness of core instruction based on progress monitoring data.
28. I think my school does a good job of addressing the academic needs of students at tier 2 (small group).
29. I think my school does a good job of addressing the behavior needs of students at tier 3 (small group).
30. I adapt the environment, curriculum, and instruction based on each student's academic data.
31. I adapt the environment, curriculum, and instruction based on each student's behavior data.
32. When I'm concerned about a student's academic success, I collaborate with a team to identify interventions.
33. I feel that the team that addresses academic needs makes informed decisions.
34. When I'm concerned about a student's behavior success, I collaborate with a team to identify interventions.
35. I feel that the team that addresses behavioral needs makes informed decisions.
36. I think my school does a good job of addressing the academic needs of students at tier 3 (intensive).
37. I think my school does a good job of addressing the behavior needs of students at tier 3 (intensive).
38. I regularly see students move between tiers of support as their academic needs change.
39. I regularly see students move between tiers of support as their behavior needs change.

Appendix B

New Survey – Post Factor Analysis

Survey Questions

1. I have a clear understanding of the phrase “tiered levels of academic and behavior support.”
2. I am involved in meetings where data results are discussed and problem solving occurs.
3. I am involved in action planning tiered supports with the other staff and administrators at my school.
4. I collaborate with my colleagues on a regular basis.
5. I think my school has an effective process in place to identify available resources (e.g., materials, technology, people).
6. I feel that my administrators are committed to implementing tiered levels of academic supports.
7. I feel that my administrators are committed to implementing tiered levels of behavior supports.
8. I think my school is a good place to work.
9. I receive coaching/mentoring to implement evidence-based instructional practices.
10. I receive coaching/mentoring to help me implement tiered levels of academic support.
11. I receive coaching/mentoring to help me implement tiered levels of behavior support.
12. I regularly communicate with families regarding student academic goals/progress.
13. I regularly communicate with families regarding student behavior goals/progress.
14. I make informed decisions based on feedback from families.
15. I am able to meet the students’ diverse needs.
16. I think my school does a good job of addressing the academic needs of students at tier 1 (universal).
17. I think my school does a good job of addressing the behavior needs of students at tier 1.
18. I think my school does a good job of addressing the academic needs of students at tier 2 (small group).
19. I think my school does a good job of addressing the behavior needs of students at tier 3 (small group).
20. I feel that the team that addresses academic needs makes informed decisions.
21. I feel that the team that addresses behavioral needs makes informed decisions.
22. I think my school does a good job of addressing the academic needs of students at tier (intensive).
23. I think my school does a good job of addressing the behavior needs of students at tier (intensive).
24. I regularly see students move between tiers of support as their academic needs change.
40. I regularly see students move between tiers of support as their behavior needs change.