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Effects of Response to Intervention on Academic Achievement in High School Literacy and Mathematics

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EFFECTS OF RESPONSE TO INTERVENTION ON ACADEMIC ACHIEVEMENT IN HIGH SCHOOL LITERACY AND MATHMATICS

by

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THE EFFECTS OF RESPONSE TO INTERVENTION ON ACADEMIC ACHIEVEMENT IN HIGH SCHOOL LITERACY AND MATHEMATICS

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Dissertation

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ABSTRACT

by
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Title: Effects of Response to Intervention on Academic Achievement in High School Literacy and Mathematics (Under the direction of Dr. Michael D. Brooks)

This study examined the effects of a multi-tiered Response to Intervention (RTI) framework on literacy and math in an effort to determine the potential benefits in a secondary setting. Specifically, this study compared literacy and mathematics achievement for 9^{th}, 10^{th}, and 11^{th} grade students, as measured by end-of-course exams, between a secondary school utilizing RTI and a secondary school not using RTI. Furthermore, the disaggregated test scores based on gender and socioeconomic status were analyzed from each school to determine the disparity in academic performance between groups of students, referred to as the "achievement gap".

A quantitative, causal-comparative strategy was used in this 2 X 2 factorial design study. The independent variables for Hypotheses 1 and 3 included participation the RTI (participation versus non-participation) and gender (male versus female). For Hypotheses 2 and 4, the independent variables included participation in RTI and socioeconomic status (Regular versus Low). The dependent variable for Hypotheses 1 and 2 was literacy achievement, and the dependent variable for Hypotheses 3 and 4 was mathematics achievement.

The findings suggest that the RTI students did not have a statistically significant advantage over the non-RTI students. However, the achievement gap between low socioeconomic and regular students was significantly smaller in the RTI sample than in the non-RTI sample. Given the emphasis that federal legislation places on closing the achievement gap, these findings should be encouraging to districts implementing RTI.

In conclusion, the findings support the argument that secondary educators would benefit from additional studies of RTI models actively implemented in secondary schools in order to determine which ones are yielding measurable improvements in student achievement.

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CHAPTER 1

INTRODUCTION

In an ideal educational setting, students would receive instruction from qualified and effective teachers, and all would possess the appropriate learning experiences and abilities to progress through the expected learner outcomes at a steady pace. However, students come to the education system with different learning experiences and a variety of abilities; therefore, schools are increasingly finding a disparity or gap in learning between groups of students. Statewide assessments and the resulting accountability measures have put an impetus on finding a system to help close the learning disparity these assessments reveal.

The National Governor's Association (2007) defined an academic achievement gap as a measurable difference between the performance of groups of students, especially groups defined by gender, socioeconomic factors, and race or ethnicity. According to Grant (2009), the achievement gap illustrates restricted life chances and choices for many students; thus, educators enable all learners to reach their fullest potential only by addressing these inequities. Grant (2009) went on to say the academic achievement gap in math and reading is especially noticeable.

One model being used to help close this gap is the Response to Intervention (RTI) model. Schools are not mandated or required to adopt an RTI model, but many are choosing to do so in response to the Individuals with Disabilities Education Improvement

Act of 2004 or (P.L. 108-446) (IDEA, 2004). Although IDEA 2004 did not specifically mention the phrase *response to intervention*, the law did say districts “may use a process that determines if the child responds to scientific, research-based intervention as a part of the evaluation…” [p. 118 (6) (B)]. Because RTI evolved from IDEA 2004 under the section related to specific learning disabilities, some think RTI is about identifying students with these learning disabilities (Tilly, 2006). Tilly noted although RTI data can be used as a component for special education determination, RTI’s primary purpose has always been to improve instruction for all students. RTI models were designed as an approach for establishing learning environments, so they are effective, efficient, relevant, and durable for all students, families, and educators (Sugai, 2007).

RTI models are generally a multi-tiered system of interventions (usually three), becoming more intense based on student response (Hoover & Patton, 2008). Tier 1 encompasses quality instruction in the general education classroom. Tier 2 provides small group instruction for students slightly below grade level, and Tier 3 is for small groups of students performing well below grade level. In many RTI models, Tier 3 involves students with substantial needs that can best be met with special education services (Johnson, Mellard, Fuchs, & McKnight, 2007). Simply put, RTI is an educational framework designed for prevention, intervention, and monitoring. The prevention of student failure, the intervention in the learning process, and monitoring of student learning are all vital components of the RTI model.

Statement of the Problem

The purposes of this study were four-fold. First, the purpose of this study was to determine the effect by gender of a school district’s use of a RTI format versus a school district not using a RTI format on literacy achievement measured by the End of Level Literacy test for 11th grade students in two central Arkansas high schools. Second, the purpose of this study was to determine the effect by socioeconomic status of a school district's use of a RTI format versus a school district not using the RTI format on literacy achievement measured by the End of Level Literacy test for 11th grade students in two central Arkansas high schools. Third, the purpose of this study was to determine the effect by gender of a school district's use of a RTI format versus a school district not using the RTI format on geometry achievement measured by the End of Course Geometry test for 9th and 10th grade students in two central Arkansas high schools. Fourth, the purpose of this study was to determine the effect by socioeconomic status of a school district's use of a RTI format versus a school district not using the RTI format on geometry achievement measured by the End of Course Geometry test for 9th and 10th grade students in two central Arkansas high schools.

Background

When President Bush signed into law The No Child Left Behind (NCLB) Act of 2001, an expanded role of the federal government began in public education. Several measures were enacted holding schools responsible for student achievement. Some of the changes included four key areas. First, in the area of testing, states were required to begin testing students annually in reading and mathematics (NCLB, 2001). In Arkansas, this resulted in the development of The Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) which is comprised of testing components including the Benchmark Examinations at Grades 3-8 and The Iowa Tests® at Grades 1, 2, and 9 (Arkansas Department of Education, 2010). End-of-Course Examinations for students completing Algebra I or the equivalent, Geometry or the equivalent, and Biology are also components of ACTAAP (Arkansas Department of Education, 2011b). Second, in the area of reporting student progress, beginning in 2002-2003, school districts were required to produce an annual report card showing student performance on annual testing (NCLB, 2001). Third, regarding teacher qualifications, the law made it clear children should be receiving instruction from a *highly qualified teacher* by 2006. A highly qualified teacher is one who is licensed and is proficient in his or her subject matter. The fourth area involved academic progress. Schools were required to make *adequate yearly progress* on the annual testing with a goal of 100% of students reaching grade level (proficiency) in math and literacy by the 2013-2014 school year. This adequate yearly progress goal is a federal formula that applies to both the entire student population and certain demographic groups (sub-populations). The law outlined various measures to encourage schools to meet these goals.

As one might expect, the No Child Left Behind Act has been a source of controversy and debate since its inception. The emphasis on testing and the goal of 100% proficiency in math and literacy caused increasing frustration among educators. In 2011, the U.S. Secretary of Education, Arne Duncan, predicted 82% of schools would not reach adequate yearly progress that year and be classified as failing (McNeil, 2011). In Arkansas, approximately 40% of the 853 accredited schools did not meet adequately yearly progress in 2011 (NORMES, 2011).

The No Child Left Behind Act has placed pressure on schools across the nation to raise student achievement in math and literacy (Gable, Hester, Hester, Hendrickson, & Size, 2005). Given the increased focus of assessment and accountability provisions in

NCLB, it is especially critical that appropriate and effective evaluation measures and intervention practices be in place for underperforming groups of students (Ernst, Miller, Robinson, & Tilly, 2005).

On December 3, 2004, 2 years after the signing of NCLB 2001, President George W. Bush signed into law the Individuals with Disabilities Education Improvement Act of 2004 (IDEA, 2004). In the IDEA, a student's responsiveness to research-based interventions may be considered in identifying students with specific learning disabilities. Specifically, Sec. 614.b.6.B of IDEA stated, "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" (p.118). With IDEA 2004, the use of RTI models, as a determinant for students' eligibility for a learning disability, began to be debated.

Some began to see RTI as a means of meeting the needs of all students who struggle with learning. Duffy (2007) asserted the RTI approach holds promise for supporting all struggling learners. According to Fuchs, Fuchs, and Stecker (2010), people associated with IDEA and NCLB have "different answers…about the nature and purpose of RTI" (p. 301). For those focusing on NCLB, RTI was seen as a way to increase proficiency for all students. For those focusing on IDEA, RTI was seen as a way to identify students with learning disabilities.

The definition of RTI varies, but most define it with the same characteristics. For example, Jenkins (2003) defined RTI as a way to "provide timely and correct intervention to every child who requires additional or different instruction from that given in normally effective general education classrooms" (p. 2). The National Research Center on

Learning Disabilities uses the following definition, “RTI is an assessment and intervention process for systematically monitoring student progress and making decisions about the need for instructional modifications or increasingly intensified services using progress monitoring data” (Johnson, Mellard, Fuchs, & McKnight, 2006, pp. 1-2). Perhaps, the National Association of Secondary School Principals (n.d.) defined it best on their website, “Many labels and misperceptions surround RTI. It is a system-wide effort involving school improvement that involves general education, compensatory education and special education. It is important to note that RTI is both a special education and general education process…” (para. 2). Because of RTI’s multi-faceted and multi-tiered approach, they noted students at all performance levels could find help to make progress toward the goals of their education program.

RTI most often involves a tiered approach to providing interventions to students with increasing intensity at each tier (Tilly, 2003). The multi-tiered approach is designed to deliver research-based instruction shaped by data, with intervention opportunities made available in the general education setting. Many discussions have arisen concerning how many tiers would be most effective; however, the 3-tiered model is used most frequently (Tilly, 2003; Vaughn, 2003).

In the 3-tier model, Tier 1 refers to the general education classroom (Johnson et al., 2006). In the general classroom, there is instruction, progress monitoring, and support that all students receive from highly qualified teachers. When students begin to experience academic difficulty, they receive more specialized remediation within the general education setting. Tier 1 is often described as a universal intervention because it is available to all students. The success of this tier relies heavily on the high-quality instruction component of the No Child Left Behind Act of 2001 (NCLB, 2001). However, even with a teacher's best efforts, some students need more intensified instruction.

Tier 2 is designed for those students who have not been successful in Tier 1. Duffy (2007) noted these students receive targeted interventions, and progress is monitored frequently to determine the intervention's effectiveness. If an intervention is not successful, a more intense intervention may be attempted. At this tier, Duffy added teachers typically receive support from other educators in implementing interventions and monitoring student progress. Thus, instruction is drawn from more resources, and then, strategies narrow in focus to target individualized and specific learning difficulties. Yet, even the efforts of this tier will not help every student be successful; some will still need help to make adequate progress.

Tier 3 interventions are designed to address significant problems for which students are in need of intensive help (Ervin, 2008). The third level is typically more individualized. In some schools, the last tier would involve special education services. Ervin stated the goal at Tier 3 is to remediate existing problems and prevent more severe problems. For example, a student whose reading falls significantly below his or her peers, despite Tier 2 interventions, might receive reading support from a reading specialist in Tier 3. Regardless of the tier, Ervin noted the monitoring of students' response to instruction is particularly important in determining if students should move from one tier of support to another, but making use of the different tiers is not the only component of RTI.

Because intervention tiers can vary in features such as instructional practices (Mellard, 2004), these features are important to the model's success. For example, RTI allows educators to view the complexities of a student's achievement and the link between achievement and instructional approaches. Successful implementation of RTI centers on the coordination of the district and school staff to ensure the most effective instructional approaches are used to meet the needs of students. Mellard, Principal Investigator with the National Research Center on Learning Disabilities, identified seven core elements of RTI that ensure high quality instructional strategies:

- High-quality classroom instruction
- Student assessment with classroom focus
- Universal screening
- Continuous progress monitoring
- Research-based interventions
- Progress monitoring during interventions
- Fidelity measures

To Mellard, fidelity referred to the overall quality of the intervention in each tier. Bender (2009) warned that in order to ensure fidelity, "schools need to document that not only was a scientifically valid curriculum used but also that it was used appropriately" (p. 60). However, although more school districts are using RTI with the appropriate fidelity measures, the focus has clearly been on the elementary grades (Burns & Gibbons, 2008).

Compton, Fuchs, Fuchs, and Bryant (2006) reported on a study they conducted over a 2-year period, which included 16 elementary schools in Tennessee. This study focused on first grade students identified with a reading deficit. These at-risk students were given 9 weeks of Tier 2 reading intervention. Data collected by the researchers revealed the at-risk students outperformed a control group at the end of the first year, and that gain was still measurable at the end of the second grade. Research such as this supports the promise that RTI holds for younger students. Yet, little scientific evidence exists for how RTI performs beyond elementary school-age children (National Research Center on Learning Disabilities, 2007).

Countinho and Oswald (2004) determined when high school students perform behind their peers academically; they are often placed into special education services even if they do not actually have a disability. Although RTI is considered more of a challenge at the secondary level, older students may also benefit from a tiered intervention system. The strongest contrasts between elementary and secondary schools include a shift in academic focus, the complexity of organization and scheduling, and the increasing non-school obligations of students (Sugai, 2004).

In a research brief for the National High School Center, Duffy (2007) reported few high schools have implemented tiered interventions. She went on to state:

> Although RTI has largely been of central concern in the elementary grades, students who arrive in high school performing below grade level in reading, writing or mathematics may benefit from the increased attention to instructional interventions and progress monitoring offered by RTI constructs. (p. 2)

Burns and Gibbons (2008) recognized although there are fewer attempts at implementation at the secondary level; a growing need exists to establish models with proactive interventions K-12. Ehren (2009) agreed RTI at the secondary level lacked the evidence found at the elementary level but stated, "…in this age of accountability high schools cannot afford to ignore struggling learners. It is a myth that adolescence is too late for intervention" (p. 5). Additionally, Ehren noted a growing body of research has demonstrated RTI with high school students can improve academic performance but acknowledged more research is needed.

When addressing RTI at the secondary level, researchers and educators should be willing to commit to a process that will take longer to implement and assess than implementation at the primary level (Sugai et al., 2005). The process of fully implementing an RTI format in secondary schools can take 5 to 8 years, rather than the 3 to 5 years typically seen in elementary schools (Mellard, Layland, & Parsons, 2008).

Hypotheses

To address the purpose statements in this study, the researcher generated the following null hypotheses:

1. No significant difference will exist by gender between a school district using a Response to Intervention format and a school district not using a Response to Intervention format on literacy achievement measured by the End of Level Literacy test for 11th grade students in two central Arkansas high schools.
2. No significant difference will exist by socioeconomic status between a school district using a Response to Intervention format and a school district not using a Response to Intervention format on literacy achievement measured by the End of Level Literacy test for 11th grade students in two central Arkansas high schools.
3. No significant difference will exist by gender between a school district using a Response to Intervention format and a school district not using a Response to

Intervention format on geometry achievement measured by the End of Course Geometry test for 9th and 10th grade students in two central Arkansas high schools.

4. No significant difference will exist by socioeconomic status between a school district using a Response to Intervention format and a school district not using a Response to Intervention format on geometry achievement measured by the End of Course Geometry test for 9th and 10th grade students in two central Arkansas high schools.

Description of Terms

Adequate yearly progress. Adequate yearly progress is the measure by which schools, districts, and states are held accountable for student performance under Title I of the NCLB of 2001 ("Adequate Yearly Progress," 2004).

Arkansas Benchmark Examination. The Arkansas Benchmark Examination is a criterion-referenced test centered on the Arkansas Curriculum Frameworks and used to meet the assessment requirements of the NCLB of 2001 (Arkansas Department of Education, 2011a). The Arkansas Office of Student Assessments is a division of the Arkansas Department of Education, which manages the student testing programs in the state of Arkansas.

Performance levels. Performance level refers to the four levels of student achievement on the Arkansas Benchmark Examinations (Arkansas Department of Education, 2010). These four levels include advanced, proficient, basic, and below basic.

Scale scores. These are raw scores that have been converted in order to have a common scale to allow for numerical comparison between different versions of a test (Tan & Rochelle, 2011).

Sub-population. According to NCLB (2002), a sub-population refers to economically disadvantaged students, major racial or ethnic groups, students with disabilities, and students with limited English proficiency.

Significance

Research Gaps

With the increased accountability in K-12 public schools, the culture in education has placed a greater emphasis on data-based decision making. Some consider the data-based RTI model to be the initiative with the greatest promise to improve education for all students (Tilly, 2006). It is important to understand that RTI is not an intervention itself but is a model that stresses the use of student data for selecting the correct intervention.

Samuels (2009) reported RTI as a model for boosting student achievement has “taken off like wildfire,” but when it comes to research specific to secondary schools, “the flame abruptly fizzles out” (p. 20). Brozo (2009) concurred by observing that the literature has documented a need for further study at the secondary level regarding RTI to address the challenges students face in secondary settings.

Johnson and Smith (2008) suggested faculty at the secondary setting often have less data to use when developing strategies for intervention. However, Fuchs, Fuchs, and Compton (2010) observed, “many researchers avoid middle and high schools entirely because of the scheduling problems and compliance issues often encountered when working with adolescents" (p. 22). For this reason, they question the appropriateness of RTI at the secondary level until more research is amassed.

Although many questions about RTI at the high school level still exist, many districts across the nation are implementing RTI in their high schools and sharing reports of positive impacts on learning and student achievement (Muoneck & Shankland, 2009). Although these types of reports are encouraging, it seems apparent that scientific-based research is needed to validate the effectiveness of RTI at the secondary level. Thus, the purpose of this study was to determine RTI's effectiveness on literacy and mathematics achievement in a high school setting.

Potential Implication for Practice

This study is significant because it will add quantitative research in the area of RTI at the high school level. The results will provide data that will distinguish if there is a significant difference in student achievement from schools that participated in RTI and those who did not. Specifically, the research will provide data of the effects of RTI on the achievement of students on the Arkansas End of Level Literacy Exam and the End-of-Course Geometry Exam. The data also addressed whether interaction effects existed between gender and socioeconomic factors as measured by lunch status. This data will provide useful data to help close the achievement gap between different sub-populations of secondary students.

Process to Accomplish

Design

A quantitative, causal-comparative strategy was used in this 2 x 2 factorial between-groups design study. The independent variables for Hypotheses 1 and 3 included participation in RTI (participation versus non-participation) and gender (male versus female). For Hypotheses 2 and 4, the independent variables included participation in RTI and socioeconomic status determined by students' lunch status (free/reduced versus regular). The dependent variable for Hypotheses 1 and 2 was literacy achievement measured by the End of Level Literacy test for 11th grade students. The dependent variable for Hypotheses 3 and 4 was math achievement measured by the End of Course Geometry test for 9th and 10th grade students. Both tests were part of the Arkansas Comprehensive Testing, Accountability, and Assessment Program.

Sample

The samples for this causal-comparative study were randomly drawn from two accessible populations of 9th through 11th grade students from two central Arkansas high schools. The schools were selected based on the criteria including participation in RTI, school size, and overall socioeconomic status. In addressing Hypothesis 1, the researcher identified all 11th grade students in school A, which used RTI, and divided them by gender. Next, students not completing the End of Level Literacy test during the Spring 2012 semester were eliminated. Then, an equal number of males and female students were randomly chosen from each sub-group for the two RTI groups (RTI males and RTI females). The researcher used the same procedure to draw the two Non-RTI groups (Non-RTI males and Non-RTI females) from school B, which did not use RTI. To address Hypothesis 2, the researcher identified all 11th grade students in school A, which used RTI, and divided them by lunch status and gender. Next, students not completing the End of Level Literacy test during the Spring 2012 semester were eliminated. Then, an equal number of male and female free/reduced lunch students and regular pay lunch students were randomly chosen from each sub-group for the two RTI groups (RTI free/reduced and RTI regular). The researcher used the same procedure to draw the two Non-RTI groups (Non-RTI free/reduced and Non-RTI regular) from school B, which did not use RTI.

In addressing Hypothesis 3, the researcher identified all 9th and 10th grade students in school A, which used RTI, and divided them by gender. Next, students not completing the End of Course Geometry test during the Spring 2012 semester were eliminated. Then, an equal number of males and female students was randomly chosen from each sub-group for the two RTI groups (RTI males and RTI females). The researcher used the same procedure to draw the two Non-RTI groups (Non-RTI males and Non-RTI females) from school B, which did not use RTI. To address Hypothesis 4, the researcher identified all 9th and 10th grade students in school A, which used RTI, and divided them by lunch status and gender. Next, students not completing the End of Course Geometry test during the Spring 2012 semester were eliminated. Then, an equal number of male and female free/reduced lunch students and regular pay lunch students were randomly chosen from each sub-group for the two RTI groups (RTI free/reduced and RTI regular). The researcher used the same procedure to draw the two Non-RTI groups (Non-RTI free/reduced and Non-RTI regular) from school B, which did not use RTI. No attempt was made to equalize the samples regarding grade level for Hypotheses 3 and 4.

Instrumentation

The Arkansas Comprehensive Testing, Assessment, and Accountability Program is the approved assessment system for Arkansas under NCLB (Arkansas Department of

Education, 2011a). Two of the assessments used in the program served as the instruments for collecting student data; specifically, the literacy and math scores from the criterion-referenced tests for Grades 9-11 were used. These tests included the End of Level Literacy test for Grade 11 and the End-of-Course Geometry test taken by students in Grades 9 and 10. According to the Arkansas Department of Education (2011c), each examination consists of multiple-choice and open-response questions that directly assess student knowledge. The end-of-course examinations include items aligned to the standards of specific courses within the Arkansas Curriculum Frameworks.

The Grade 11 Literacy Examination includes items aligned to the Arkansas English Language Arts Curriculum Framework. Arkansas teachers and the Arkansas Department of Education (2011c) developed items for both the Grade 11 Literacy Examination and End-of-Course Examinations. The Grade 11 Literacy Examination assesses student performance in reading and writing. The topics include reading and comprehension of text, recognition and application of specialized vocabulary, demonstration of competency in writing using proper English conventions, and conveying ideas clearly through word choice (Arkansas Department of Education, 2012b). According to the Arkansas Comprehensive Testing, Assessment, and Accountability Program Pre-Assessment Handbook (2013), all students in Grade 11 are required to take the Grade 11 Literacy Examination.

The End-of-Course Geometry test, taken by students in Grades 9 and 10, is based on the Geometry Mathematics Curriculum Frameworks. The topics covered in this exam include the five strands found in the geometry frameworks: language of geometry, triangles, measurement, relationships between two-and three-dimensions, and coordinate geometry and transformations (Arkansas Department of Education, 2006). All students who complete Geometry or the equivalent, for high school graduation credit at the end of the spring semester take the Geometry end-of-course examination in the spring (Arkansas Department of Education, 2013).

All students take each examination on the same date throughout the state. Licensed teachers administer the examinations and must sign affidavits of testing procedures compliance. The Arkansas Office of Student Assessment reported the Arkansas Comprehensive Testing, Assessment, and Accountability Program uses tests that have technically sound levels of reliability, validity, and fairness, based on the extensive research that underlies the CRT item sets (Arkansas Department of Education, 2012a).

There are four levels of student achievement on the state's CRTs. The four levels are advanced, proficient (grade level), basic and below basic. However, for the purposes of this study, raw or scale scores were used. Each one of these four achievement levels correspond to a range of scale scores. The Department of Education explained the use of scale scores as follows:

> When multiple forms of a test are used, or when results are compared from year to year, scale scores are needed to adjust for possible differences in test form length or difficulty. Scale scores provide a useful measurement tool for many assessment programs. Scale scores are routinely used in many other statewide testing programs, providing the basis for long-term, meaningful comparisons of student results across different test administrations. Scale scores are intended to make scores more meaningful by defining a scale of measurement not tied to a

> particular form of a test. However, to be meaningful, the scale must be tied to a benchmark that is meaningful to the user. The Arkansas Benchmark Examinations were constructed so a specific score for mathematics or literacy (reading and writing), corresponds to the advanced, proficient, basic, and below basic performance levels. (Arkansas Department of Education, 2012c, p. 1)

The End-of-Course Exam results are posted on the School Performance section of the National Office for Research, Measurement and Evaluation Systems (NORMES) web site. The data are also provided to individual schools to inform decision making at the local level.

Data Analysis

To address the first hypothesis, a 2 x 2 factorial analysis of variance (ANOVA) was conducted using participation in RTI and gender as the independent variables and literacy achievement as the dependent variable. The researcher conducted a 2 x 2 factorial ANOVA for the second hypothesis, using participation in RTI and socioeconomic status as the independent variables and literacy achievement as the dependent variable. To address the third hypothesis, a 2 x 2 factorial ANOVA was conducted using participation in RTI and gender as the independent variables and math achievement as the dependent variable. The researcher conducted a 2 x 2 factorial ANOVA for the fourth hypothesis, using participation in RTI and socioeconomic status as the independent variables and literacy achievement as the dependent variable. To test the null hypotheses, the researcher used a two-tailed test with a .05 level of significance.

CHAPTER II

REVIEW OF THE LITERATURE

Data from the National Assessment of Educational Progress (America's Report Card) indicated a large literacy and math achievement gap between Black-White and between Hispanic-White in the years from 1984 to 2004 (Perie, Moran, & Lutkus 2005). In 2001, the graduation rates for Black (50%) and Hispanic (53%) students were well below White (75%) and Asian (77%) students (Swanson, 2004). Similarly, the report, *Diplomas Count: An Essential Guide to Graduation Policy and Rates* (Olson, 2006), stated that in 2006 more than 1.2 million students—most of them members of minority groups—did not graduate from high school in 4 years with a regular diploma. According to the National Center for Educational tatistics, approximately 3.5% of high school students drop out of school every year (Chapman, Laird, & KewalRamani, 2010).

Statistics such as these highlighted the need for instructional reform in schools. In response to this need, Burns, Appleton, & Stehouwer (2005) suggested there is compelling evidence that Response to Intervention (RTI) is the best hope for giving every student the support needed to learn at a high level. Ciolfi and Ryan (2011) offered this definition of RTI:

> RTI is simply an effort at common sense. The essential idea is that all students should be given adequate instruction. Those who are not keeping up should be given extra help in small groups. If that extra help does not do the trick, they

> should be given even more intense and individualized assistance. Stripped of jargon, that is RTI in a nutshell. (p. 311)

In 2005, the National Association of State Directors of Special Education defined RTI as the practice of providing scientific, research based instruction and intervention matched to students' needs (Batsche et al., 2005). Regardless of the exact wording in the definition, foundational to RTI is the belief that educators can effectively teach all learners, regardless of their backgrounds and life experiences (Hollenbeck, 2007).

This chapter was dedicated to reviewing the literature in the area of RTI and was divided into seven sections. The first section provides the historical perspective of RTI. The second section presented the legislative initiatives for current education reform. The third section presented the 3-tiered Intervention Model and the attributes of each tier. The fourth section summarized the components of an RTI model. The fifth section compared and contrasted the two accepted approaches to RTI. The sixth section reviewed the previous research on literacy and math intervention. Finally, the seventh section reported on the successes and challenges of RTI at the secondary level.

Historical Perspective of Response to Intervention

Although the term Response to Intervention (RTI) emerged from recent initiatives, many of the components of RTI are supported by 30 years of research. In the early 1970s, Stanley Deno investigated a 3-tiered intervention model to monitor students' progress in reading and math (Batsche et al., 2005). Around the same time, John Bergan began working with a model that focused on behavioral interventions for students. These two researchers are often cited for laying the foundation for the current RTI models. Most RTI models implemented today include components from these models.

In the same vein, Welch, Brownell, and Sheridan (1999) credited M. C. Will's 1985 speech as an important precursor to the RTI movement in the field of special education. Will, then Assistant Secretary for the Office of Special Education and Rehabilitative Services, U.S. Department of Education, gave a speech entitled *Educating children with learning problems: A shared responsibility* (Will, 1986). The speech called for earlier intervention before requiring more drastic special services.

In 1983, President Ronald Reagan presented the publication of the National Commission on Excellence in Education (1983) titled *A Nation at Risk*. This commission found the U.S. educational system to be inadequate and contained this statement concerning the nation's schools:

> The educational foundations of our society are presently being eroded by a rising tide of mediocrity that threatens our very future as a nation and a people. What was unimaginable a generation ago has begun to occur—others are matching and surpassing our educational attainments…we have allowed this to happen to ourselves. (p. 1)

This report alerted Americans that their schools were failing, and it generated a wave of local, state, and federal reform efforts. Furthermore, it began decades of debate about public schools and reforms, which continue today.

In response to the enduring negative public perception of the U.S. educational system, Congress passed Goals 2000: Educate America Act (1994). Heise (1994) noted that Goals 2000 recognized the overall failure of past, incremental educational reform efforts and embraced a new approach: systemic reform. Heise observed Goals 2000 established ambitious educational goals that involved comparing content standards, instructional goals, and periodic assessments of student performance with those goals. This 1994 act dramatically increased the role of the federal government in public education. This expanded role continued into the current decade with legislation that brought RTI to national attention.

Legislative Initiatives for Current Education Reform

The recent growth of RTI was stimulated by two key pieces of legislation: The No Child Left Behind Act of 2001 (NCLB) and the Individuals with Disabilities Education Improvement Act reauthorized in 2004 (IDEA) (Buffum, Mattos, & Weber, 2009). These pieces of legislation provided a framework built on the unifying beliefs that all children can learn and early intervention is the key to preventing or minimizing long-term problems. Noteworthy in both of these acts, according to Fletcher and Vaughn (2009), was the emphasis on early intervention services and service delivery models that focus on the children's response to intervention. NCLB contains numerous provisions aimed at ensuring the academic growth and achievement of all students regardless of their race, ethnicity, disability or socioeconomic status. The passage of NCLB was a message from national leaders that schools must accept responsibility for student achievement, particularly with students who are most at risk of failure.

Strollar, Poth, Curtis, and Cohen (2006) stated, "The high standards and expectations of NCLB are highlighting the needs of a growing number of at-risk students and students with disabilities and are raising awareness of the discrepancies in academic performance across students" (p. 10). By demanding high standards, Stroller et al. noted NCLB promised to close the achievement gap and have all students performing at the proficient level by 2014.

Messelt (2004) praised the focus on data found in NCLB. He asserted that although schools have been collecting data for decades, such as enrollment figures, discipline incidents, and attendance, only recently have school districts discovered the power of data for school improvement. He went on to state that when used correctly, data-driven decision making could help to narrow achievement gaps, improve teacher quality, and improve curriculum development.

One outcome of the NCLB data collection mandate was the determination of students' adequate yearly progress (AYP). To make AYP as defined by NCLB, public schools must meet yearly targets set by their state for the percentages of students scoring proficient on state tests and other performance indicators. According to a report by the Center on Education Policy (Usher, 2012), an estimated 48% of the nation's public schools did not make AYP in 2011. This report also noted that the percent of Arkansas schools not making AYP in 2011 was 35%. Usher (2012) cautioned that because state tests vary, a comparison of AYP between states is not recommended.

Not everyone was convinced that NCLB would make a difference in the academic growth of students. For example, Harvard testing expert Daniel Koretz (2008) argued that the entire NCLB accountability system was not based on hard evidence. Koretz said,

> We know far too little about how to hold schools accountable for improving student performance. NCLB and its state-level forebears—dating back to the first minimum competency testing programs some three decades ago—have been based on a shifting combination of common sense and professional judgment, not on hard evidence. Despite intermittent progress for several decades, we still have very large gaps in performance between the poor and the well-off. (pp. 9-10)

Similarly, the Civil Rights Project concluded in 2006 that NCLB was failing to close the achievement gap, would not make its 2014 goals and has not significantly improved reading and math achievement (Lee, 2006).

Most would agree that NCLB helped expand the standards and accountability movement. Arne Duncan (2009), then U.S. Secretary of Education, said this about NCLB, "Today, we expect districts, principals and teachers to take responsibility for the academic performance of their schools and students. We can never let up on holding everyone accountable for student success. That is what we are all striving for" (para. 18). With lawmakers focusing on academic standards and AYP, many states and schools began looking at RTI in general education settings with an eye on increasing student achievement. The 2004 amendments to IDEA paved the way for the RTI model to be expanded to special education settings. Burns and Gibbons (2008) reported that IDEA allows a process "based on the child's response to scientific, research based intervention" to determine eligibility for special education services (p. 7). Furthermore, IDEA authorized school districts to use up to 15% of their special education funds for "Early Intervening Services", for which RTI qualifies (Ciolfi & Ryan, 2011, p. 310).

However, Fuchs, Fuchs, and Compton (2010) warned that it is important to note that RTI is a prevention system designed to prevent long-term academic failure, and not designed solely to prevent special education eligibility. In theory, RTI can help distinguish between those who truly have a disability and those who are receiving poor instruction (Ciolfi & Ryan, 2011). Because NCLB and IDEA allow for RTI, rather than require it, school districts will have to decide if RTI is a model that will help their students with academic shortcomings.

Today, RTI is being adopted by states and school districts across the country. However, RTI is still in its early stages, and neither NCLB nor IDEA specifies precisely how RTI should be implemented. In many districts, RTI is still more of a theory than an actual program (Zirkel & Thomas, 2010).

The 3-Tiered Intervention Model

Commonly described as a multi-tiered service delivery system involving assessment and intervention for struggling learners, RTI was initially used to enable early intervention in reading (Hollenbeck, 2007). Since the IDEA reauthorization, however, RTI has been applied in schools from preschool to high school, and across mathematics, writing, and spelling (Berkeley, Bender, Peaster, & Saunders, 2009).

The 3-tiered RTI models and 4-tiered models exist, with each model having unique characteristics. Mellard and Johnson (2008) described RTI as a 3-tiered model that "…aligns the instructional needs of students with increasingly intense interventions in the same way the public health model is organized with primary, secondary, and tertiary intervention levels" (p. 63). Regardless of which RTI model is chosen, as students move through the tiers, the degree, intensity, duration, and types of instruction administered to the student increases, and the number of students targeted decreases (Batsche et al., 2005). This review focused on the more common 3-tiered models.

Tier 1 is for 100% of the student population. Hollenbeck (2007) noted that at the heart of the first tier is high-quality instruction. He asserted that if students are not receiving quality instruction in Tier 1, it would be difficult to determine if students are struggling because they need specific help or they were the victim of poor teaching. Ciolfi and Ryan (2011) concurred:

> If RTI can only be implemented once there is high-quality, research-based instruction for every student, many students are going to be waiting a long time for RTI. Alternatively, where schools implement RTI before their general education system is sound, RTI will rest on a shaky foundation. (p. 314)

To meet this challenge, most RTI researchers emphasized the need for professional development in the first tier, with a focus on research-based instruction. Researchers Vaughn, Wanzek, Woodruff, and Linan-Thompson (2007) described three elements they concluded were essential in Tier 1. First, a core curriculum based on scientifically validated research. Second, the screening and benchmark testing of students at least 3 times per year (i.e., fall, winter, and spring) to determine instructional needs. Finally, an ongoing professional development to provide teachers with the necessary tools to ensure every student receives quality instruction.

A successful Tier 1 program should meet the needs of 75 to 80% of the student population (Buffum et al., 2009). For students who need additional targeted instruction/intervention, Tier 2 is added. According to the book, *Pyramid Response to Intervention*, Buffum et al. noted each level of tiered support should last 6 to 8 weeks, with Tier 2 interventions occurring at least three days a week for 30 minutes a session.

Previous research showed that at the secondary level, Tier 2 often is a specific reading or math class provided as a supplement to regular instruction (Burns & Gibbons, 2008). In his book, *Beyond the RTI Pyramid*, Bender (2009) reported, "the broad body of available research suggests that between 40 and 60 percent of students who are struggling in either reading or math will have those academic problems alleviated or eliminated by a Tier 2 intensive supplemental intervention" (p. 15). In their study of Tier 2 interventions, researchers Vaughn and Roberts (2007) found, “a minority, less than 10% of all secondary intervention students, makes little or no substantial progress when provided with a research-based, standardized intervention” (p. 44). In fact, Vaughn and Roberts concluded that these interventions would ultimately close the achievement gap between current performance and expected performance.

Edmonds et al. (2009) conducted a meta-analysis of 13 literacy studies that examined the effects of decoding, fluency, vocabulary, and comprehension Tier 2 interventions on students in Grades 6–12. The mean weighted average effect size of these studies on comprehension outcomes was 0.89, in favor of treatment students over comparison students. These results suggested that older students with reading problems benefited from interventions.

According to Griffiths, Parson, Burns, VanDerHeyden, and Tilly (2007), Tier 2 interventions are the most researched aspect of RTI. Griffiths et al. pointed out that RTI research frequently found positive effects, perhaps because “RTI shifts our focus from high-inference to low-inference assessments, from internal causes of problems to environmental causes of problems (such as curriculum and instruction) and from process to results” (p. 35). Students who have not responded to Tier 1 and Tier 2 will be provided Tier 3 interventions, which are designed to be individualized, intensive long-term supports.

In some models of RTI, Tier 3 is special education; in others, it is the last step before special education (Ciolfi & Ryan, 2011). Burns et al. (2005) found that approximately 20% of students in Tier 1 did not sufficiently respond, and in Tier 2, approximately 6% of the students did not respond acceptably. However, they noted less than 2% did not sufficiently respond in Tier 3 and were considered for special education services.

In a study of the implementation of a 3-tiered RTI model conducted by Ardoin, Witt, Connell, and Koenig (2005), students who did not adequately respond to secondary interventions underwent a peer-tutoring model for Tier 3. This more intensive intervention resulted in gains in fluency for four out of five students.

Most researchers agree that as the interventions increase in intensity, the group size should decrease. However, a meta-analysis of 29 intervention studies by Elbaum, Vaughn, Hughes, and Moody (2000) did not support the belief that individual one-to-one tutoring is far superior to small group instruction. Additionally, Vaughn and Linan-Thompson (2003) found no significant difference in the outcome of reading ability between group sizes of 1:1 and 1:3, but both small groups scored higher than a class size of 1:10.

Regardless of the specific interventions chosen for each tier, districts are encouraged to design their RTI model to fit their situation. RTI is a way for educators to develop their unique tiered-model of interventions based on their district's needs (Duffy, 2007). However, there are vital components found in every model.

Components of an RTI Model

A review of the literature indicated a variety of RTI models; however, all models have common key elements. Regarding the necessary components, Batsche et al. (2005) wrote,

> The large-scale implementation of any professional practice requires an understanding of the core principles that guide the practice as well as the

components that define the practice. The principles on which RTI is based are supported by research and common sense. (p. 19)

According to the National Center on Response to Intervention, at The National High School Center (2010), the generally accepted components for RTI include high-quality classroom instruction, universal screening, research-based interventions, progress monitoring, and fidelity.

High-quality Classroom Instruction

The primary goal of this component is to ensure that students' difficulties are not due to lack of high-quality, research-based instruction. Examples of high-quality classroom instruction include intensive writing across the curriculum, core curriculum aligned to the state content standards, and differentiated instructional strategies to meet the needs of all learners (Biancarosa & Snow, 2006). Allington (2002), researcher and professor, said this about classroom instruction:

> It has become clearer that investing in effective teaching–whether in hiring decisions or professional development planning–is the most "research-based" strategy available. If we are to hope to attain the goal of "no child left behind," we must focus on creating a substantially larger number of effective, expert teachers. (p. 740)

Not only is research-based instruction a component of RTI, NCLB also requires evidence from scientifically based research to justify funding for educational programs and activities (Beghetto, 2003). Once it is determined that the instruction is sufficient, the next step would be to screen all students.

Universal Screening

Universal screening involves assessing all students to determine which students are at-risk of needing intensive help beyond Tier 1. Screening is fundamental and foundation to RTI (Burns, Dean, & Klar, 2004). Examples of universal screening at the secondary level might include standardized achievement tests, report card grades, and end-of-course exams. Research showed that many secondary schools screen by examining students who failed English and/or math classes. Jimerson, Reschly and Hess (2008) reported on research where data indicated that not passing ninth grade algebra and/or English is significantly correlated with dropping out. This suggested that the use of grades as a screening method has the potential to be effective for high school use.

Jenkins (2003) advised schools to select one to three measures that correlate well with the state accountability test. Researchers who use multiple measures for screening obtain better accuracy (Jenkins & O'Connor, 2002). Educational researchers, Compton, Fuchs, and Fuchs (2007), also reported better screening accuracy for a battery of measures than for single measures.

Burns, Sarlo, and Pettersson (2010) indicated the most commonly used assessment for screening literacy at the secondary level is a measurement of oral reading fluency. Oral reading fluency consists of the number of words that a student can read correctly per minute. If this type of measurement is not available, results from district-or state-wide annual achievement tests can be used to identify at-risk students. These achievement tests should result in reasonable good predictions, given that Spring-Spring and Fall-Spring achievement correlations are typically strong (Jenkins, 2003).

Jenkins (2003) observed there are surprisingly few studies of screening measures beyond second grade. However, Vaughn et al. (2010) indicated that screening data might not be as critical in secondary school due to years of available academic data already on each student. Once students are targeted for interventions, the question then becomes, what intervention should be used?

Research-based Interventions

Barton (2008) suggested that interventions at the high school level should focus on helping students stay in school and experience postsecondary success. Interventions might include remedial courses, tutoring, extended learning programs, small-group instruction, student support teams, and additional instructional time.

The primary criterion for interventions according to NCLB is they must be scientifically based. Throughout NCLB, educators are cautioned that funding for instructional materials and education programs must be justified by evidence from scientifically based research (Beghetto, 2003). Despite extensive discussion, Beghetto (2003) noted that universal agreement about the exact meaning of the definition of scientifically based interventions in NCLB remains elusive.

The National High School Center (2010) cautioned that RTI requires formal processes to support students. These include intensive interventions for all students who require it, rather than depending solely on the willingness of individual teachers to provide interventions. Yet, with any intervention, frequent monitoring is necessary to determine if the intervention is working.

Progress Monitoring

Progress monitoring, according to the research, can be as simple as class grades, quizzes, class tests, and benchmark tests. Researchers Vaughn et al. (2008) stated, "All RTI models require tools measuring progress and instructional response so that decisions can be made concerning instructional intensity and differentiation. These tools are well-developed for elementary school, but less work has been completed at a secondary level" (p. 341). According to Bender and Shores (2007), most of the current RTI research implemented progress monitoring either weekly or every other week in Tier 2 and Tier 3. Jenkins, Graff, and Miglioretti (2009) found less frequent monitoring may be just as beneficial as more frequent monitoring.

However, Bender (2009) noted, "daily monitoring of performance is considered the gold standard for intensive instruction…the obvious problem with daily performance monitoring is that it can be quite time-consuming…in light of this concern, weekly or bimonthly performance monitoring during Tier 2 is recommended" (p. 55). Bender stated, daily performance monitoring of intensive intervention is preferable in Tier 3.

The outcome of student progress, or lack of student progress, will not be valid or useful without fidelity of the RTI implementation. In order to prevent a misinterpretation of outcome data, fidelity of implementation provided the necessary evidence of what was done to impact the outcome (Miller, 2010).

Fidelity

Fidelity refers to how closely the aspects of the RTI model are followed. In a RTI model, fidelity is important at both the school level (e.g., implementation of the program) and the teacher level (e.g., implementation of instruction and progress monitoring) (Johnson, Mellard, Fuchs, & McKnight, 2006). Fidelity is being personally and collectively accountable to the systems, and practices agreed upon as a staff and/or district (Miller, 2010).

According to the National High School Center (2010), the "coordination of the numerous components involved in RTI implementation is especially complex at the high school level and thus lends itself to lower fidelity of implementation…" (p. 9). Blase, Fixsen, and Duda (2011) pointed out that often what is implemented is not used with fidelity, is not sustained for a useful period, and is not used on a scale sufficient to affect the problem.

Johnson et al. (2006) advised that professional development is a key component of RTI fidelity. They encouraged professional development topics such as high-quality core instruction, literacy across the content areas, assessment tools, data analysis, differentiated instruction, and tiered intervention. Similarly, Scammacca et al. (2007) asserted that professional development is the key to establishing high levels of fidelity, noting that the more information and expertise teachers have about the intervention, the greater the chance the intervention will have an impact on students. Bender and Shores (2007) alleged that although professional development is helpful, the most effective way to assure treatment fidelity is actual observation of Tier 2 or Tier 3 instruction for at least one instructional period. Any licensed educator trained in the implementation of the specific intervention could conduct observations.

The expertise with which an intervention is implemented can influence the size of effects, with greater fidelity increasing the chances of obtaining a larger treatment effect (Scammacca et al., 2007). Scammacca et al. (2007) asserted that researcher-provided intervention is usually delivered with greater fidelity; however, effects from teacher-implemented interventions remain significant. Key indicators of RTI fidelity in general education include 80-85% of students pass tests, improved results over time, and a high percentage of students on trajectory (Reschly & Gresham, 2006). Further, field experiences conducted by Hawkins, Kroeger, Musti-Rao, Barnett, and Ward (2008) led researchers to predict that RTI will continue to evolve with these five core characteristics forming the basis of state initiatives founded on intervention strategies.

Two Approaches to RTI

The two types of approaches of RTI involve the standard protocol and the problem-solving approach. First, standard protocol, or standardized protocol, involves educational interventions that have been validated as effective through experimental studies (Mellard & Johnson, 2008). This standard intervention or interventions would be implemented for all students who score below a certain grade or score set by the school (Hall, 2008). It is important to note that these standard protocol interventions are empirically validated and used with all students performing at low levels (Vaughn et al., 2008). Vaughn et al. (2008) found that for the majority of older students, intervention is likely to occur in group-sizes that range from 3-18 students. For this reason, standardized (standard protocol) interventions are usually used rather than individualized approaches. There are advantages to standardized interventions including more structure for teachers.

Second, the problem-solving, or individualized, approach uses supports already in place, such as a problem-solving team, to identify the needs of a target student based on collected data (Bender & Shores, 2007). These teams serve to increase student achievement and may be in the form of a team, in which groups of students are discussed, or individual problem solving, in which a team gathers to discuss one student. In this approach, a team would review and analyze individual student data, then devise intervention strategies for the deficit areas (Duffy, 2007). According to Kovaleski and Glew (2006), "The problem-solving model, and particularly its implementation in the context of collaborative teams, has over time evolved from a process to assist teachers with difficult to teach children to a frequently proposed major component of school reform efforts" (p. 16). The problem-solving approach resembles the teaching cycle in which teachers, "study, select, plan, implement, analyze, and adjust their instruction based on the needs of the students" (Mellard & Johnson, 2008, p. 85). Researchers Mellard and Johnson (2008) described the problem-solving approach as resembling the teaching cycle, in which teachers study the needs of their students before planning instruction and adjust their instruction as those needs change. Fuchs (2003) identified four problem-solving models that are consistent with RTI: Heartland Educational Agency Model (Iowa), Ohio's Intervention-Based Assessment, Pennsylvania's Instructional Support Teams, and Minneapolis' Public School's Problem-Solving Model. These four successful models are widely accepted as large-scale implementations of RTI (Fuchs, 2003).

As previously noted, older students are usually subject to standard protocol interventions; however, Vaughn et al. (2008) stated:

> Particularly with older students, individualized interventions may be necessary because the range of reading difficulties is likely to vary based on the learning needs of students, the reasons for their reading difficulties, and the gap between their performance and grade-level expectations. (p. 341)

Because standard protocol is used more frequently than the problem-solving approach, Vaughn et al. went on to say, “there is a specific need not only for randomized controlled trials of RTI models implementing individualized interventions but also for a direct comparison of individualized and standard protocol interventions” (p. 341). Simply put, the standard-protocol model designs interventions for small groups with the same academic problem, and the problem-solving model targets interventions for individual student needs. Schools may choose to implement either method or a combination of the two methods.

Intervention Research

Children struggle with mathematics and reading for many reasons including growing up in economically disadvantaged settings, emotional difficulties, and even inadequate academic instruction (Donovan & Cross, 2002). As noted earlier, reforms in education have increased the accountability for educators today to reach every student regardless of ethnic background, economic status, or disability (Stecker, Lembke, & Foegen, 2008).

As a student progresses through school, reading demands increase with more complex vocabulary and text. This is not a new issue; Stanovich (1986) noted almost 30 years ago:

> Students who read slowly and laboriously read fewer words overall and often become reluctant readers who struggle to learn. Later, when students need to read to learn, their reading difficulty creates difficulty in most other subjects. In this way, they fall further and further behind in school, dropping out at a much higher rate than their peers. (p. 364)

In his extensive research on reading, Stanovich found that falling behind grade-level in reading skills can set a student up for a lifetime of academic failure without effective and early intervention. Balfanz, Legters, and Jordan (2004) noted that struggling readers drop out of high school at a higher rate and will not possess the skills necessary for 21st century jobs.

In addition to the achievement differences that will occur because of being a poor reader, Butkowsky and Willows (1980) found that the motivational side effects are just as damaging. In their study of fifth-grade readers, Butkowsky and Willows revealed that among poor readers, reading failure influenced performance on non-reading tasks. The researchers concluded that children with reading difficulties demonstrated lower motivation in all academic situations, thereby increasing their odds of failure.

To summarize this early research on reading, poor readers had cognitive and motivational consequences that affected performance on all future academic tasks. RTI produced a framework for educators to provide interventions for these struggling students regardless of their grade level. "Expectations introduced by the need for an increasingly literate society and demands for meeting yearly progress goals introduced by NCLB legislation require the enhancement of literacy instruction for all secondary students" (Vaughn et al., 2008, p. 343). In further support of RTI at the secondary level, Lipka, Lesaux, and Siegel (2006) outlined the following reasons that older students may need help, particularly with reading. First, not all students receive substantive and/or adequate early intervention. Second, some students receive effective intervention early but struggle later when text and knowledge demands increase. Third, some students manifest reading difficulties later who did not have reading difficulties early, referred to as *late-emerging* reading difficulties.

Scammacca et al. (2007) conducted a meta-analysis where they studied the effectiveness of 31 interventions for older students who are poor readers. Studies for the analysis ranged from sample sizes of 13 to 115 and included Grades 4-12. Overall, Scammacca et al. (2007) found that some of the interventions were powerful enough to narrow the gap between the poor readers and the average readers at their grade level. However, there was no evidence the interventions in the 31 studies were sufficient to bring the struggling readers' skills up to grade level proficiency. The researchers noted the following conclusions from this meta-analysis:

- Adolescence is not too late to intervene.
- Teaching comprehension strategies to older students is beneficial, although average gains in reading comprehension are somewhat smaller than those in other reading areas studied.
- Older students benefit from improved knowledge of word meanings and concepts.
- Teachers can provide interventions that are associated with positive effects.
- Word-study interventions and interventions focused at both the word and the text level are appropriate for older students.
- Additional research that uses measures more similar to those used by schools (group-administered) to monitor reading progress is needed.

Additional studies of reading interventions with older students revealed a positive outcome on vocabulary development when using strategies such as direct instruction, computer-assisted instruction, cognitive strategy instruction, and activity-based methods (Jitendra, Edwards, Sacks, & Jacobson, 2004).

In reviewing the research, there appeared to be a well-established research base for reading instruction and literacy interventions. Research should provide the basis for Tier 1 instruction and Tier 2 and 3 interventions. However, math interventions, particularly at the secondary level, are not found as frequently as interventions for reading and literacy. East (2006) stated,

> Although there is less research in math in secondary schools, it is not correct to indicate that there is no research. There are large-scale implementations of RTI in real schools that involve multiple grade levels and reading, math, and behavior. The problem is one of scaling, which is a different research question than one invoked when we ask whether practices like RTI are effective or implementable. (para 6)

Fuchs (2006), Vanderbilt University researcher, advised there is nothing about math that requires a different RTI approach. Fuchs stated that the main questions for implementing RTI were the same across the curriculum. However, as the research base for effective math interventions for secondary students builds, the kinds of student needs that may be met needs to be studied further (Fuchs, 2006).

Like many education reform efforts, RTI initiatives have focused largely on elementary schools due to preexisting infrastructure (Muoneke & Shankland, 2009). However, the positive impact of RTI on students in early grades led schools to look at expanding RTI to high schools (Gersten et al., 2009).

RTI at the Secondary Level

As many as 70% of secondary students require some form of remedial instruction to develop adequate reading skills for success in life after high school (Biancarosa & Snow, 2004). The timeline for helping students before they graduate is considerably shorter at the secondary level; therefore, the importance of maximizing interventions is intensified. Torgesen, Rashotte, Alexander, Alexander, & MacPhee (2003) reported that older students who are struggling because they have previously had inadequate instruction might respond well to an intervention.

According to Scammacca et al. (2007), their research found,

> Effect sizes were larger in studies where participants were middle-grade students, as opposed to high school students. Intervention is most effective when it is provided as early as possible. However, older students do respond to intervention and all students who are struggling in reading should receive intervention. (p. 16)

Ehren and Whitmire (2007) pointed out that although it is important to intervene in the early grades, it is just as important to remember the struggling learners in high school. In fact, they asserted, secondary students who lack the strategies needed to be successful in school are at risk for failing or dropping out, which makes the stakes high for this age group.

Joseph Harris, project director at the National High School Center, said the growing emphasis on student achievement helped facilitate the increase of RTI in high schools. Harris said,

> Over the last 5 years or more, there's been an increased focus on more rigor, increased graduation rates, and higher-level courses. At the same time, there's

> been this steady progression of students coming up through elementary and middle school who are significantly below grade level or who have specific issues with literacy and numeracy, and there's been no venue to address that. (Muoneke & Shankland, 2009, p. 8)

Even if RTI is implemented in the early grades, it may be insufficient for some students, and the increasingly sophisticated vocabulary and comprehension needed for secondary school will cause some students who had not previously demonstrated reading difficulties to struggle (Vaughn et al., 2008). Lipka et al. (2006), who reported in their study that students with late-emerging reading difficulties are frequently average students in Grade 2, but started to show a decline in word identification, word attack, and comprehension thereafter, supported this finding.

Vaughn et al. (2008) conveyed there is little guidance for the applicability of RTI models for students in secondary grades. Mellard (2009), director of the University of Kansas Center for Research In Learning, concurred saying, "without scientific literature outlining an overall method for applying RTI to secondary schools, educators only have best guesses for what components a program should have to be successful" (p. 1). However, the National High School Center (2010) countered that there is substantial information out there for high schools to study:

> ….a rich source of knowledge is the collective and continuing experiences of high schools that have already ventured ahead with RTI. These information resources typically take the form of anecdotal reports, case studies, or professional wisdom, and although they are not a substitute for more rigorous forms of inquiry, they can

> provide insight into the challenges that high schools implementing RTI faced…. (p.v)

The National High School Center then examined several high school RTI models and reported some of the current practices. One of these practices included using RTI primarily for literacy and mathematics and using it for a semester class period in lieu of electives. Other RTI options included seminars, lab classes, or other academic supports during the day. Another practice allowed students to exit tiered support at semester breaks. One practice for RTI Tier 2 included large group instruction or smaller groups with the focus on vocabulary, comprehension, and study skills in Literacy or Math. Still another Tier 3 practice incorporated small group or individual students with a focus on basic skills such as phonics.

Currently, although RTI has been clearly focused on the elementary level, there are some notable programs at the secondary level (Burns & Gibbons, 2008). For example, Palmer High School, a 1,800-student school in Colorado Springs, started an RTI program by opening a tutoring center, which they staffed all day (Samuels, 2009). Samuels (2009) reported that students were screened with the Measures of Academic Progress, which is a computerized assessment aligned to state standards. Students attended the tutoring center for reinforcement in a particular subject. Samuels noted an examination of grades for students in Algebra and Geometry who received interventions through the center earned higher grades for the semester compared to students who did not use the center.

Walla Walla School District, a 6,000-student district in rural Eastern Washington, implemented a 3-tiered intervention program in 2004 as a pilot program for Washington (Barton, 2008). By 2007, special education referrals had dropped by 13.6%, and the district saw gains in secondary students passing the reading and writing portions of the Washington Assessment of Student Learning test. The district concluded, according to Barton (2008), that tiered interventions resulted in 63.8% of all 7th graders and 78.9% of all 10th graders passing the Washington Assessment of Student Learning. The principal at Walla Walla stated that although the Washington Assessment of Student Learning is certainly a focus, their interventions also focused on helping students stay in school and experience postsecondary success.

Telfer (2011) reported the results of five districts and their efforts at RTI. Schools focused their interventions on different goals, all with positive results. For example, the Bloom Vernon, Ohio school is in a small district that focused their efforts on making AYP for students with disabilities. In 2010, after implementation of a data-driven intervention, Bloom Vernon's Performance Index exceeded 100 for the first time. The Performance Index is used in Ohio as part of the state accountability system and indicated how well students perform on assessments. The highest Performance Index score a district can have is 120. On the opposite end of the size spectrum, Telfer (2012) reported on the Tigard-Tualantin School District, which is the ninth largest district in Oregon with 37% of their students identified as minority. This district focused on improving literacy and closing the racial achievement gap. After RTI, the passing rate on the fifth-grade state writing assessment increased from 32% in 2010 to 50% in 2011. The gap between minority students and non-minority students also was narrowed. In 2007, only 47 % of minority students passed the fifth-grade state reading test as compared to 86% of the non-minority students. By 2009-2010, 77% and 93% of minority and non-minority respectively passed the test. Telfer noted that the Tigard-Tualantin district worked with the Oregon State Department to train other districts interested in RTI.

When looking at RTI in a secondary environment, it should be noted there are some unique obstacles. First, according to Samuels (2009), the greatest difficulty reported by secondary teaching staffs was the inflexibility of student schedules. Scheduling additional instruction and times to assess the students' progress was difficult (Samuels, 2009). Scheduling in high schools creates challenges and requires flexibility not only in scheduling but also for delivery of interventions. Second, another concern was the fragmented day that high school students have as they move among different classes and teachers. Accordingly, Muoneke and Shankland (2009) reminded secondary educators that because of their departmental structure and schedule constraints, high schools can screen students at the grade level, department-wide, or school-wide. The researchers also pointed out that a third challenge is the limited availability of effective instructional techniques and interventions that work across content areas in high schools (Muoneke & Shankland, 2009). Additionally, when older students are behind, the amount of interventions needed will be more extensive. This is the result of both the amount of the information that older students are expected to know and the longer period of time that some of these students have struggled (Vaughn et al. 2008).

Research found that many secondary schools provided programs and interventions before, during, and after school but found that the students that needed help the most are often the most inconsistent when it comes to attending sessions outside of the normal school day (Burns & Gibbons, 2008). Ehren and Whitmire (2007) warned that secondary students resisted any intervention efforts they viewed as being singled out, even if it is for their benefit. Most research seemed to support providing intervention through required classes as part of the students' normal schedule.

Conclusion

Education research and legislative initiatives have occurred simultaneously to increase momentum for the implementation of RTI in the nations' schools. A review of the literature revealed a long history of evidence-based education practices such as Stanley Deno's and John Bergman's in the 1970s (Batsche et al., 2005). These practices, paired with legislative acts such as NCLB and IDEA, helped fuel the RTI movement. Although RTI was not explicitly named in the NCLB and the IDEA regulations, these two pieces of legislation stimulated the growth of RTI as a means of addressing students at-risk of failure. Both pieces of legislation focused on the quality of instruction received in the general education setting and held schools accountable for the achievement of all students. No universal RTI model existed, however, it was generally accepted that multiple tiers were effective methods that provided needed support to students (Mellard & Johnson, 2008).

Many researchers agreed that RTI is seen as a way to serve struggling learners earlier. Two RTI models have emerged: a standard protocol model and the problem-solving model. Both approaches use core elements of RTI such as universal screening, research-based interventions, progress monitoring, and fidelity control. Both models have shown to be favorable in the literature, according to the National Research Center on Learning Disabilities (2005).

Although there are no randomized controlled trials on the RTI process in secondary schools, there are research-based instructional strategies (Muoneke &

Shankland, 2009). Although secondary school RTI may differ in design from earlier grades, core elements essential to any RTI framework exist (Canter, Klotz, & Cowan, 2008). One crucial element is fidelity of implementation. Research indicated that if interventions are implemented with integrity and closely monitored, they have a much greater chance of being successful (Gresham, 1989).

As with any change, not all educators welcome the RTI initiative. Some see this as just another reform with, "frustrated teachers abandoning approaches, new ones appear, and the pendulum swings again" (Nichols, 2009, p. 1). Klotz and Canter (2006) emphasized that although federal regulations offered guidance; each school district must develop and implement its own procedures based on state regulations, resources, and the needs of its students.

CHAPTER III

METHODOLOGY

A review of the literature revealed an increased interest in research about educational practices and approaches to instruction. Much of this interest has been fueled by legislation such as NCLB and IDEA, both of which require research-based practices. In particular, NCLB legislation challenged schools to close the achievement gap between high- and low-performing children, between minority and nonminority students, and between disadvantaged children and their more advantaged peers (Allington, 2012). As a result, many districts have turned to RTI, which focuses on evidence-based practices, systematic assessments, and a multi-tiered model for providing interventions. RTI provides a system for identification of academic difficulties prior to student failure. RTI is not a curriculum or program; instead, it a conceptual framework. This framework promotes high-quality instruction for all students and interventions for students who do not respond to the instruction.

The literature further revealed that although researchers have studied the effects on student achievement in elementary schools using a RTI format, limited research has been conducted to determine the effectiveness of RTI in secondary schools (Duffy, 2007). Fewer school districts have used RTI at the secondary level as compared to the elementary level, and a growing need exists to establish secondary models in an effort to build proactive interventions at a systemic level K-12 (Burns & Gibbons, 2008).

This study examined the effects of RTI on literacy and math in an effort to determine the potential benefits in a secondary setting. Specifically, this study compared literacy and mathematics achievement for 9th, 10th, and 11th grade students between a school using RTI and a school not using RTI, as measured by end-of-course exams. The researcher developed the following hypotheses:

1. No significant difference will exist by gender between a school district using a Response to Intervention format and a school district not using a Response to Intervention format on literacy achievement measured by the End of Level Literacy test for 11th grade students in two central Arkansas high schools.
2. No significant difference will exist by socioeconomic status between a school district using a Response to Intervention format and a school district not using a Response to Intervention format on literacy achievement measured by the End of Level Literacy test for 11th grade students in two central Arkansas high schools.
3. No significant difference will exist by gender between a school district using a Response to Intervention format and a school district not using a Response to Intervention format on geometry achievement measured by the End-of-Course Geometry test for 9th and 10th grade students in two central Arkansas high schools.
4. No significant difference will exist by socioeconomic status between a school district using a Response to Intervention format and a school district not using a Response to Intervention format on geometry achievement measured by the

End-of-Course Geometry test for 9th and 10th grade students in two central Arkansas high schools.

This chapter details the research design, the sample population to be studied, the instrumentation and data collection procedures, an explanation of the analytical methods used, and limitations considered in the study.

Research Design

A quantitative, causal-comparative strategy was used in this 2 x 2 factorial between-groups design study. The independent variables for Hypotheses 1 and 3 included participation in RTI (participation versus non-participation) and gender (male versus female). For Hypotheses 2 and 4, the independent variables included participation in RTI and SES determined by students' lunch status (free/reduced versus regular). According to the U.S. Department of Education (2012a), free/reduced lunch eligibility data are used for accountability, research, and statistical analysis by education agencies and the research community. They noted education researchers frequently use free/reduced lunch eligibility as an indicator of student economic status. They reasoned that other measures of SES such as parents' education background or education aspirations for their children are difficult to obtain. As previously mentioned, in Arkansas, free/reduced lunch eligibility is used to define SES for NCLB accountability reports.

The dependent variable for Hypotheses 1 and 2 was literacy achievement measured by the End of Level Literacy test for 11th grade students. The dependent variable for Hypotheses 3 and 4 was math achievement measured by the End-of-Course geometry test for 9th and 10th grade students. Both tests are part of the Arkansas Comprehensive Testing, Accountability, and Assessment Program.

Sample

The samples for this causal-comparative study were taken from two accessible populations of 9th through 11th grade students from two central Arkansas high schools. One school had adopted a tiered-model of intervention, and this school served as the RTI site. The other school did not use RTI, and this school served as the non-RTI control site. In 2012, the Arkansas Department of Education categorized both schools selected for this study as *Achieving* (ADE Data Center, 2013). According to the U.S. Department of Education (2012b), this category was based on the districts' performance, growth, and graduation rates. They noted performance and growth rates were determined by using assessment results from the 2011 Benchmark Exams for Grades 3 through 8 math and literacy, Grade 11 Literacy Exam, and End-of-Course exams for algebra and geometry. Furthermore, the two schools had similar demographics as emphasized in Table 1 (ADE Data Center, 2013).

Table 1.

Demographics for the RTI and Non-RTI Schools

	RTI School	Non-RTI School
Total Enrollment K-12	3194	3166
2012 Graduates	215	207
Enrollment 9th-12th	915	917
Males 9th-12th	447	452
Females 9th-12th	468	465
Free/Reduced Lunch (SES)	41.3%	28.4%

In addressing Hypothesis 1, the researcher identified all 11th grade students in the RTI School and divided them by gender. Next, students not completing the End of Level Literacy test during the Spring 2012 semester were eliminated. Then, an equal number of males and female students were randomly chosen from each subgroup for the two RTI groups (RTI males and RTI females). The researcher used the same procedure to draw the two Non-RTI groups (Non-RTI males and Non-RTI females) from the Non-RTI School. To address Hypothesis 2, the researcher identified all 11th grade students in the RTI School and divided them by lunch status and gender. Next, students not completing the End of Level Literacy test during the Spring 2012 semester were eliminated. Then, an equal number of male and female free/reduced lunch students and regular pay lunch students were randomly chosen from each subgroup for the two RTI groups (RTI free/reduced and RTI regular). The researcher used the same procedure to draw the two Non-RTI groups (Non-RTI free/reduced and Non-RTI regular) from the Non-RTI School. Table 2 examines the total populations available for Hypothesis 1 and Hypothesis 2 (ADE Data Center, 2013).

Table 2.

RTI and NON-RTI School Populations Completing the End of Level Literacy Exam

	RTI School	Non-RTI School
Total Population Tested (2012)	208	191
Males	108	94
Females	100	97
Free/Reduced (SES)	72	59
Regular Lunch	136	132

In addressing Hypothesis 3, the researcher identified all 9th and 10th grade students in the RTI School and divided them by gender. Next, students not completing the End-of-Course Geometry test during the Spring 2012 semester were eliminated. Then, an equal number of males and female students were randomly chosen from each sub-group for the two RTI groups (RTI males and RTI females). The researcher used the same procedure to draw the two Non-RTI groups (Non-RTI males and Non-RTI females) from the Non-RTI School. To address Hypothesis 4, the researcher identified all 9th and 10th grade students in the RTI School and divided them by lunch status and gender. Next, students not completing the End-of-Course Geometry test during the Spring 2012 semester were eliminated. Then, an equal number of male and female free/reduced lunch students and regular pay lunch students were randomly chosen from each subgroup for the two RTI groups (RTI free/reduced and RTI regular). The researcher used the same procedure to draw the two Non-RTI groups (Non-RTI free/reduced and Non-RTI regular) from the Non-RTI School. No attempt was made to equalize the samples regarding grade level for Hypotheses 3 and 4. Table 3 examines the total population available for these hypotheses (ADE Data Center, 2013).

Table 3.

RTI and NON-RTI School Populations Completing the End-of-Course Geometry Exam

	RTI School	Non-RTI School
Total Population Tested (2012)	207	210
Males	101	103
Females	106	107
Free/Reduced (SES)	80	65
Regular Lunch	127	145

Instrumentation

The Arkansas Comprehensive Testing, Assessment, and Accountability Program is the approved assessment system for Arkansas under NCLB (Arkansas Department of Education (2008). Two of the assessments used in the program served as instruments for collecting student data, specifically the literacy and math scores from the criterion-referenced tests for Grades 9-11 were used. These tests included the End of Level Literacy test for Grade 11 and the End-of-Course Geometry test taken by students in Grades 9 and 10. According to the Arkansas Department of Education (2011c), each examination consists of multiple-choice and open-response questions that directly assess student knowledge. The examinations include items that are aligned to the standards of courses contained within the Arkansas Curriculum Frameworks.

The Grade 11 Literacy Examination includes items that are aligned to the Arkansas English Language Arts Curriculum Framework. Arkansas teachers and the Arkansas Department of Education (Arkansas Department of Education, 2011c) developed items for both the Grade 11 Literacy Examination and End-of-Course Examinations. According to the Arkansas Comprehensive Testing, Assessment, and Accountability Program Pre-Assessment Handbook (Arkansas Department of Education, 2013a), all students in Grade 11 are required to take the Grade 11 Literacy Examination.

The End-of-Course Geometry test, taken by students in Grades 9 and 10, is based on the Geometry Mathematics Curriculum Frameworks. All students who will complete Geometry or the equivalent for high school graduation credit at the end of the spring semester will take the Geometry end-of-course examination in the spring (Arkansas Department of Education, 2013a).

The Arkansas Department of Education (2013b) has contracted with Questar Assessment, Incorporated for the development, production, distribution, and collection of the end-of-course testing. As reported by the education department, this independent contractor uses proven test construction practices in the design, scoring, scaling and reporting. Furthermore, an independent technical advisory committee of experts with documented assessment and psychometric training observe and advise (Arkansas Department of Education, 2008).

All students take each examination on the same date throughout the state. Licensed teachers administer the examinations and must sign affidavits of testing procedures compliance. The Arkansas Office of Student Assessment reported that the Arkansas Comprehensive Testing, Assessment, and Accountability Program uses tests that have “Technically sound levels of reliability, validity, and fairness, based on the extensive research that underlies the CRT item sets” (Arkansas Department of Education, 2013c, para. 1). Results of the examinations are provided for all students, schools, and districts to be used as the basis for instructional change.

Four levels of student achievement exist on the state's CRTs. The four levels are advanced, proficient (grade level), basic, and below basic. However, for the purposes of this study, raw or scale scores were used. Each one of these four achievement levels corresponds to a range of scale scores (Arkansas Department of Education, 2012c). For the End-of-Course Geometry test, the levels and scores consist of the following: Advanced (250 and above), Proficient (200-249), Basic (154-199), Below Basic (153 and below). For the End-of-Level Literacy test, the levels and scores consist of the following: Advanced (228 and above), Proficient (200-227), Basic (169-199), Below Basic (168 and below). The End-of-Course Exam results are posted on the School Performance section of the National Office for Research, Measurement and Evaluation Systems (NORMES) web site. The data are also provided to individual schools to inform decision making at the local level.

Data Collection Procedures

After receiving Institutional Review Board (IRB) approval (see Appendix), the researcher met with the Superintendent of School-RTI and the Assistant Superintendent of School Non-RTI to discuss the data needed for the study. The researcher from each participating school district received a formal permission letter. The researcher then compiled from the student database the pertinent information needed for the study and downloaded the data onto a flash drive for transfer to the researcher's computer. To ensure student confidentiality, a number replaced the name of each student. The student data were transferred to an Excel spreadsheet in preparation of analysis.

Analytical Methods

To address the first hypothesis, a 2 x 2 factorial analysis of variance (ANOVA) was conducted using participation in RTI and gender as the independent variables and literacy achievement as the dependent variable. The researcher conducted a 2 x 2 factorial ANOVA for the second hypothesis, using participation in RTI and SES as the independent variables and literacy achievement as the dependent variable. To address the third hypothesis, a 2 x 2 factorial ANOVA was conducted using participation in RTI and gender as the independent variables and math achievement as the dependent variable. The researcher conducted a 2 x 2 factorial ANOVA for the fourth hypothesis, using participation in RTI and SES as the independent variables and literacy achievement as the dependent variable. To test the null hypotheses, the researcher used a two-tailed test with a .05 level of significance.

Limitations

It is important to note any limitations that might have influenced the results of this study. First, schools administered the instruments used for this study annually and provided a readily available source of achievement data. However, teachers were encouraged to give practice tests and use released items from previous tests in their classrooms. It is well known that scores on a test can increase as students become familiar with the test's format, "with or without real improvement in the broader achievement constructs that tests and assessments are intended to measure" (Linn, 2000, p. 4). Therefore, classroom assessments may serve as a more accurate method of measuring RTI success than high-stakes standardized assessments.

Second, the data collected for the study were based on one testing session. Most researchers agree that when possible, the same individuals should be assessed over different periods (Anderman, 2009). Anderman pointed out that these studies, called longitudinal studies, provide better developmental data because the distinct data points represent the same individuals across different periods.

CHAPTER IV

RESULTS

The purpose of this quantitative study was to compare a school using RTI and a school not using RTI on literacy and mathematics achievement for 9th, 10th, and 11th grade students as measured by End-of-Course exams. The study also investigated the interaction of participation in the RTI model with the variables of gender and socioeconomic status. Therefore, the independent variables were RTI participation (RTI versus non-RTI), gender (male versus female), and socioeconomic status (free/reduced lunch versus regular students). The dependent variables were literacy and math achievement measured by the End of Level Literacy and End-of-Course Geometry exams. Initially, a series of descriptive statistics are presented in order to provide an illustration of this sample of respondents and the data set analyzed. Following this, a series of four sections present and discuss the results of the factorial ANOVAs conducted testing the four hypotheses included in this study. These analyses incorporate respondent gender, socioeconomic status, and RTI participation as independent variables and focus upon literacy scores as well as geometry scores as the outcome measures of interest.

Descriptive Statistics

First, a series of descriptive statistics were conducted on these data, which are summarized in this section. The researcher analyzed the data in this study using IBM® SPSS® Statistics for Windows software. The statistical assumptions of normality and homogeneity of variances were checked prior to running the statistical analysis. Table 4 summarizes the demographics conducted on the literacy data and the math data.

Table 4

Demographics for Students for both Literacy and Geometry

Variable	Literacy		Geometry	
	N	%	*N*	%
Total Gender				
Male	210	52.1	216	50.6
Female	193	47.9	211	49.4
Total SES				
Free/Reduced	124	30.8	149	34.9
Regular	279	69.2	278	65.1
Non-RTI, Gender				
Male	101	51.0	118	53.6
Female	97	49.0	102	46.4
Non-RTI, SES				
Free/Reduced	55	27.8	69	31.4
Regular	143	72.2	151	68.6
RTI, Gender				
Male	109	53.2	98	47.3
Female	96	46.8	109	52.7
RTI, SES				
Free/Reduced	69	33.7	80	38.6
Regular	136	66.3	127	61.4

With respect to the entire sample in literacy, a slight majority of males was indicated, with close to 70% of respondents being regular lunch students rather than free/reduced lunch students. These results were found to be similar when focusing specifically upon the RTI and non-RTI participation samples. With respect to the geometry sample, these data also indicated a slight majority of male respondents, with slightly over 65% of the sample being regular lunch students rather than free/reduced lunch. These percentages found were relatively similar to those indicated with respect to the RTI and non-RTI participation samples.

Descriptive statistics were conducted on the continuous measures, which consisted of literacy, as well as geometry scores. Literacy scores were found to have a mean of 213.56, with similar means found for the RTI and non-RTI participation samples. Next, with regard to the geometry sample, a mean of 235.01 was indicated, with a substantially higher mean found in the non-RTI participation sample and a substantially lower mean found with respect to the RTI sample.

Null Hypothesis 1

The first hypothesis stated no significant difference will exist by gender between a school district using a Response to Intervention format and a school district not using a Response to Intervention format on literacy achievement measured by the End of Level Literacy test for 11th grade students in two central Arkansas high schools. Table 5 summarizes the results of the factorial ANOVA conducted for Hypothesis 1. As shown, the interaction between these two measures was not significant. Therefore, the main effects were analyzed. RTI participation was not found to achieve statistical significance, but gender was found to achieve significance.

Table 5

General Linear Model for Null Hypothesis 1

Source	*SS*	*df*	*MS*	*F*	*p*	*ES*
RTI	48.87	1	48.87	0.16	.687	.000
Gender	4986.90	1	4986.90	16.64	.000	.040
RTI*Gender	63.89	1	63.89	0.21	.645	.001
Error	119601.42	399	299.75			
Total	18504380.00	403				

As reported in Table 5, there was insufficient evidence based on the interaction of the variables to reject the first null hypothesis, $F(1,399) = .21$, $p = .645$. Given that there was no significant interaction between the variables of gender and participation, the main effect of each variable was examined separately. The main effect for gender was significant, $F(1, 399) = 16.64$, $p < .001$, $ES = .040$, and the main effect for participation was not significant, $F(1, 399) = 0.16$, $p = .687$.

Table 6 displays the group means and standard deviations for RTI participation by gender on literacy achievement for 11th graders. The primary focus with respect to this table consists of the means based on respondent gender because gender was the sole significant factor found with respect to this model. These results indicate that females had significantly higher mean values on literacy as compared with male respondents.

Table 6

Descriptive Statistics for RTI Participation by Gender for Literacy Achievement

Gender	RTI Participation	*M*	*SD*	*N*
Male	Non-RTI	210.24	17.78	101
	RTI	210.14	18.35	109
	Total	210.19	18.04	210
Female	Non-RTI	216.49	16.41	97
	RTI	217.98	16.47	96
	Total	217.23	16.41	193
Total	Non-RTI	213.30	17.36	198
	RTI	213.81	17.89	205
	Total	213.56	17.61	403

Null Hypothesis 2

The second hypothesis stated no significant difference will exist by socioeconomic status (SES) between a school district using a Response to Intervention format and a school district not using a Response to Intervention format on literacy achievement measured by the End of Level Literacy test for 11th grade students in two central Arkansas high schools. Table 7 summarizes the results of the ANOVA conducted for Hypothesis 2. This analysis also included literacy as the outcome. As shown, statistical significance was found with respect to the interaction between RTI participation and socioeconomic status. Significance was not indicated for RTI participation alone or the main effect of socioeconomic status.

Table 7

General Linear Model for Null Hypothesis 2

Source	*SS*	*df*	*MS*	*F*	*p*	*ES*
RTI	774.26	1	774.26	2.78	.096	.007
SES	12333.59	1	12333.59	44.30	.000	.100
RTI*SES	1847.18	1	1847.18	6.63	.010	.016
Error	111098.07	399	278.44			
Total	18504380.00	403				

As shown in Table 7, the main effect for socioeconomic status was significant, $F(1, 399) = 44.30$, $p < .001$, $ES = .100$. The main effect for participation was not significant, $F(1, 399) = 2.78$, $p = .096$. However, sufficient evidence existed to reject the null hypothesis based on the interaction of the variables, $F(1, 399) = 6.63$, $p = .010$, $ES = .016$. Thus, differences did exist between the cell means with a small effect size. Because of this interaction between the levels of the variables, post hoc comparisons were made to analyze the differences among means. The analysis of all pairwise differences between means was tested using the Tukey's Honestly Significant Difference test, also called the Tukey's HSD test (Warner, 2013).

Results indicated a significant difference between four out of six sets of paired samples. The RTI/Free or reduced lunch sample mean was significantly lower than the RTI/Regular lunch sample mean ($p = .015$) and the non-RTI/Regular lunch sample mean ($p = .001$). In addition, the RTI/Regular lunch sample mean was significantly higher than the non-RTI/Free or reduced lunch sample mean ($p < .001$). Finally, the non-RTI/Free or reduced lunch sample mean was significantly lower than the non-RTI/Regular lunch sample mean ($p < .001$).

Table 8 displays the group means and standard deviations for RTI participation by socioeconomic status on literacy achievement for 11th graders. With regard to the interaction between RTI and socioeconomic status, this difference between regular and free or reduced lunch students was found to be substantially greater for the non-RTI sample as compared with the RTI sample. Second, with regard to socioeconomic status, these results indicated that students with a free or reduced lunch had a significantly lower mean literacy score as compared with regular lunch students.

Table 8

Descriptive Statistics for RTI Participation by SES for Literacy Achievement

SES	RTI Participation	*M*	*SD*	*N*
Free or Reduced	non-RTI	201.24	15.10	55
	RTI	208.91	17.88	69
	Total	205.08	17.07	124
Regular	non-RTI	217.94	15.92	143
	RTI	216.29	17.44	136
	Total	217.12	16.67	279
Total	non-RTI	213.30	17.36	198
	RTI	213.81	17.89	205
	Total	213.56	17.61	403

Null Hypothesis 3

The third hypothesis stated no significant difference will exist by gender between a school district using a Response to Intervention format and a school district not using a Response to Intervention format on geometry achievement measured by the End-of-Course Geometry test for 9th and 10th grade students in two central Arkansas high schools. Table 9 summarizes the results of the ANOVA conducted for Hypothesis 3, which focused upon geometry scores as the outcome measure. This analysis found only RTI participation to achieve statistical significance.

Table 9

General Linear Model for Null Hypothesis 3

Source	*SS*	*df*	*MS*	*F*	*p*	*ES*
RTI	22959.19	1	22959.19	16.95	.000	.039
Gender	2517.22	1	2517.22	1.86	.174	.004
RTI*Gender	782.16	1	782.16	0.58	.448	.001
Error	573147.12	423	1354.96			
Total	24181036.00	427				

There was insufficient evidence based on the interaction of the variables to reject the null hypothesis, $F(1, 423) = 0.58$, $p = .448$, $ES = .001$, as reported in Table 9. Given that there was no significant interaction between the variables of gender and participation, the main effect of each variable was examined separately. The main effect for gender was not significant, $F(1, 423) = 1.86$, $p = .174$, $ES = .004$. The main effect for participation was significant, $F(1,423) = 16.95$, $p < .001$, $ES = .039$.

Additionally, Table 10 displays the group means and standard deviations for RTI participation on geometry achievement for 9th and 10th grade students. With regard to RTI participation, a significantly higher mean geometry score was found among the non-RTI sample as compared with the RTI sample.

Table 10

Descriptive Statistics for RTI Participation by Gender for Geometry Achievement

Gender	RTI Participation	*M*	*SD*	*N*
Male	Non-RTI	238.46	39.03	118
	RTI	226.47	32.58	98
	Total	232.46	36.66	216
Female	Non-RTI	246.04	36.68	102
	RTI	228.62	38.02	109
	Total	237.33	38.29	211
Total	Non-RTI	241.97	38.06	220
	RTI	227.60	35.48	207
	Total	235.01	37.48	427

Null Hypothesis 4

The fourth hypothesis stated no significant difference will exist by SES between a school district using a Response to Intervention format and a school district not using a Response to Intervention format on geometry achievement measured by the End-of-Course Geometry test for 9th and 10th grade students in two central Arkansas high schools. Table 11 summarizes the results of the ANOVA conducted testing Hypothesis 4.

In this analysis, RTI participation, socioeconomic status, as well as the interaction between RTI and socioeconomic status were found to achieve statistical significance.

Table 11

General Linear Model for Null Hypothesis 4

Source	*SS*	*df*	*MS*	*F*	*p*	*ES*
RTI	10275.44	1	10275.44	8.43	.004	.020
SES	55629.71	1	55629.71	45.62	.000	.097
RTI*SES	5648.65	1	5648.65	4.63	.032	.011
Error	515867.04	423	1354.96			
Total	24181036.00	427				

The main effect for socioeconomic status was significant, $F(1, 423) = 45.62$, $p < .001$, $ES = .097$. The main effect for participation was also significant, $F(1, 423) = 8.43$, $p = .004$, $ES = .020$. There was also sufficient evidence based on the interaction of the variables to reject the null hypothesis, $F(1, 423) = 4.63$, $p = .032$, $ES = .011$. Thus, differences did exist between the cell means with a small effect size. Because of this interaction between the levels of the variables, post hoc comparisons were made to further analyze the differences among means. The analysis of all pairwise differences between means was tested using the Tukey's Honestly Significant Difference test, also called the Tukey's HSD test (Warner, 2013).

Results indicated a significant difference between five out of six sets of paired samples. The RTI/Free or reduced lunch sample mean was significantly lower than the RTI/Regular lunch sample mean ($p = .006$) and the non-RTI/Regular lunch sample mean

($p < .001$). In addition, the RTI/Regular lunch sample mean was significantly higher than the non-RTI/Free or reduced lunch sample mean ($p = .045$), but the RTI/Regular lunch sample mean was significantly lower than the non-RTI/Regular lunch sample mean ($p < .001$). Finally, the non-RTI/Free or reduced lunch sample mean was significantly lower than the non-RTI/Regular lunch sample mean ($p < .001$).

Table 12 displays the group means and standard deviations for RTI participation on geometry achievement for 9th and 10th grade students. First, the mean scores presented relating to the interaction between RTI and socioeconomic status indicated that a substantially greater difference in geometry scores between regular students and free or reduced lunch students was present with respect to the non-RTI sample as compared with the RTI sample. Second, with regard to RTI participation, significantly higher geometry scores were found among the non-RTI sample as compared with the RTI sample. Third, the results found in relation to socioeconomic status indicated that students on a free or reduced lunch had significantly lower geometry scores as compared with regular students.

Table 12

Descriptive Statistics for RTI Participation by SES for Geometry Achievement

SES	RTI Participation	*M*	*SD*	*N*
Free or Reduced	Non-RTI	220.23	35.70	69
	RTI	217.56	34.14	80
	Total	218.90	34.78	149
Regular	Non-RTI	251.91	34.93	151
	RTI	233.93	34.97	127
	Total	242.92	36.02	278
Total	Non-RTI	241.97	38.06	220
	RTI	227.60	35.48	207
	Total	235.01	37.48	427

Conclusion

The results indicated support for all hypotheses. However, gender differences were indicated with respect to literacy scores, and differences based on socioeconomic status were indicated based on both literacy as well as geometry scores. The following chapter will serve to discuss these results in relation to previous literature as well as discuss limitations of this study, as well as possibilities for future research.

CHAPTER V

DISCUSSION

The primary objective of this study was to contribute to the growing body of research on RTI in a secondary setting. As noted in Chapter II, compelling evidence exists that RTI can give every student the additional time and support needed to learn at high levels (Burns, Appleton, & Stehouwer, 2005). However, the majority of RTI research focused on students at the elementary level. In addition, numerous journal articles and suggestions focused on what high schools could do with RTI, but they offered little evidence for its effectiveness (Brozo, 2010). As observed by Fuchs, Fuchs, and Compton (2010), "Many researchers avoid middle and high schools entirely because of the scheduling problems and compliance issues often encountered when working with adolescents" (p. 22). Because researchers tend to avoid the high school setting, this study was conducted to fill the literature gap created by investigating effects on 9th -11th grade students.

The focus of this study was to determine the differences between RTI participation (a school using RTI and a school not using RTI) on literacy and mathematics achievement as measured by end-of-course exams for 9th, 10th, and 11th grade students. Other variables interacting with RTI participation included gender and socioeconomic status (SES). First, this chapter includes conclusions drawn based on the data collected and analyzed. Second, the implications and recommendations based on the conclusions found in the data analysis are included. Finally, future research considerations are discussed.

Conclusions

Hypothesis 1

Hypothesis 1 states that no significant difference will exist by gender between a school district using a Response to Intervention format and a school district not using a Response to Intervention format on literacy achievement measured by the End of Level Literacy test for 11th grade students in two central Arkansas high schools. To address the first hypothesis, a 2 x 2 factorial ANOVA was conducted using participation in RTI and gender as the independent variables and literacy achievement as the dependent variable. An analysis of this hypothesis revealed no significant interaction between the variables of gender and RTI participation; therefore, the interaction hypothesis could not be rejected. Of the main effects, gender was the only significant factor found; therefore, evidence was found to reject the null hypothesis for the main effect of gender. On the average, females had significantly higher mean values on literacy as compared with male respondents.

Hypothesis 2

Hypothesis 2 states that no significant difference will exist by socioeconomic status (SES) between a school district using a Response to Intervention format and a school district not using a Response to Intervention format on literacy achievement measured by the End of Level Literacy test for 11th grade students in two central Arkansas high schools. The researcher conducted a 2 x 2 factorial ANOVA for the second hypothesis, using participation in RTI and SES as the independent variables and literacy achievement as the dependent variable. An analysis of this hypothesis revealed a significant interaction between the variables of RTI and SES; therefore, evidence was found to reject this hypothesis. With regard to the interaction between RTI and socioeconomic status, the mean of the free or reduced lunch, RTI students was found to be statistically lower as compared with the other regular lunch samples regardless of RTI participation. However, the free or reduced lunch, non-RTI students, on average, was found to be statistically lower as compared with all the other samples. These findings are not surprising considering that, according to Reardon (2011), the socioeconomic status of a child has always been one of the strongest predictors of the child's academic achievement regardless of program participation. Additionally, the relationship between a family's position in the income distribution and their children's academic achievement has grown substantially stronger during the last half-century (Reardon, 2011).

The post hoc comparisons made between the variables further documented the strong influence that socioeconomic status has on student achievement. The mean of any paired sample that contained free or reduced scores was significantly lower than the regular lunch scores regardless of RTI participation.

Hypothesis 3

Hypothesis 3 states that no significant difference will exist by gender between a school district using a Response to Intervention format and a school district not using a Response to Intervention format on geometry achievement measured by the End-of-Course Geometry test for 9th and 10th grade students in two central Arkansas high schools. To address the third hypothesis, a 2 x 2 factorial ANOVA was conducted using participation in RTI and gender as the independent variables and mathematics achievement as the dependent variable. An analysis of this hypothesis revealed no significant interaction between the variables; therefore, evidence did not support rejecting this hypothesis. The only main effect that showed significance was RTI participation. A significantly higher mean geometry score was found among the non-RTI sample as compared with the RTI sample. Perhaps, as reported in Chapter II, the limited amount of research available on mathematics interventions made following the requirements of research-driven instruction set forth by NCLB and IDEA difficult. Given that the RTI school scored significantly lower on the geometry test, this result might suggest additional investigation is needed to understand these results. An analysis of individual student scores might give insight on how to improve the RTI model to serve the students struggling with geometry in a better way.

Hypothesis 4

Hypothesis 4 states that no significant difference will exist by SES between a school district using a Response to Intervention format and a school district not using a Response to Intervention format on geometry achievement measured by the End-of-Course Geometry test for 9th and 10th grade students in two central Arkansas high schools. The researcher conducted a 2 x 2 factorial ANOVA for the fourth hypothesis, using participation in RTI and SES as the independent variables and math achievement as the dependent variable. An analysis of this hypothesis revealed the interaction between RTI and SES was found to achieve statistical significance; therefore, the interaction hypothesis was rejected. First, the mean scores presented relating to the interaction between RTI and SES indicated that a statistically significant gap was discovered between the non-RTI, regular lunch students and the RTI, regular lunch students. On average, the non-RTI, regular lunch sample scored significantly higher on geometry compared to the RTI, regular lunch sample. Second, both of the free or reduced lunch student samples were lower statistically compared to the two regular lunch samples, regardless of RTI participation. Finally, the mean scores indicated a substantially smaller gap in geometry scores between regular students and free/reduced lunch students in the RTI sample as compared with the non-RTI sample. These results are encouraging considering studies conducted by Reardon (2011) found the achievement gap for test scores between regular and low SES students has grown increasingly larger over the past 25 years.

Post hoc comparisons supported the findings that socioeconomic status was a major factor in the geometry scores. However, one of the comparisons provided surprising results; regular students in a non-RTI program scored significantly higher compared to regular students in the RTI program. When providing the study results to the RTI school, the principal shared that the low geometry scores may be attributed to the use of a novice geometry teacher during this (2010-2011) school year.

Implications

Gender

Based on the results of this study, gender and RTI participation did not significantly interact to affect how students scored on the End of Level Literacy test or the End-of-Course Geometry test. However, although not significant, female students, on average, scored higher on the literacy test as well as the geometry test. The finding that females outscored males on the geometry test differs from researchers Liu and Wilson (2009). Although no differences exist in mathematics ability in the lower grades, they found that disparities exist in upper grades with boys outperforming girls. Furthermore, Liu and Wilson's research on standardized testing in mathematics also revealed a male advantage. However, other researchers have disputed these claims. They noted that growth trends on standardized tests were the same for both males and females over time (Rosselli, Ardila, Matute, & Inozemtseva, 2009).

Studies have shown that male and female students need different types of teaching strategies to be successful (Sax, 2006). Kommer (2006) found that males learn effectively if the teacher uses abstract concepts, and females need examples that are more concrete. When considering interventions for students, teachers must determine if their methods are effective for both genders. Based on these results, there does not appear to be a gender bias with the current interventions.

Socioeconomic Status

The disaggregation of students' test scores by race, gender, and SES to compare between subgroups is a requirement of NCLB (2002). Of all the requirements of NCLB, the disaggregation of data has widespread bipartisan support ("Achievement gap," 2011). This support highlights the importance seen in closing the achievement gap between subgroups, especially in SES.

Academic problems are often attributed to low socioeconomic factors. Duncan and Brooks-Gunn (1997) pointed out that students in the bottom quintile of family SES score well below those in the top quintile on standardized tests of mathematics and reading when they enter kindergarten, and these differences do not appear to narrow as children progress through school. When factoring in SES, the achievement gap is evident in at least four areas: grades, standardized test scores, dropout rates, and college completion rates ("Achievement gap," 2011).

The findings of this study support the research describing a gap in academic performance between lower and higher SES students. On both the literacy and geometry test, the gap was substantially greater for the non-RTI sample as compared with the RTI sample. Although more research is needed to support these findings, it appears the interventions at the RTI site helped close the gap between the lower SES students and the regular lunch students.

A closer look at the intervention model at the RTI school revealed components that likely benefitted the low SES students. Although some schools provide interventions before and after school, lower SES students often tend to have inconsistent attendance with this format (Sugai, 2004). The RTI site in this study incorporated an RTI period into the master schedule beginning with the 2010-2011 school year. All students had the same RTI period in their school day. Students identified as needing intervention attended tier II or tier III small group intervention daily during the RTI class period. Students not identified as needing intervention used this time working individually on homework or collaborating on group activities with their assigned teacher.

Recommendations

Potential for Practice/Policy

This study was designed to obtain information on the effectiveness of participation in RTI by gender and SES. This study was conducted in two central Arkansas high schools. The study compared literacy and geometry achievement for 9th-11th grade students. The findings of the study may have direct implications on practices and policies in districts surrounding these schools in at least three ways.

The first recommendation is that teachers and administrators considering RTI ask why this school is implementing RTI. According to Buffum, Mattos, and Weber (2010), schools that implement RTI primarily to raise test scores will struggle to reap the benefits of RTI. RTI efforts, driven by a desire to increase test scores, lead to practices that are counterproductive to the RTI process. RTI needs to be an ongoing process to improve teaching and learning and should not be reduced to a single goal of increasing test scores.

Conversely, a second recommendation is that schools should not use the results from high-stakes testing as the sole accountability measure of RTI success. Many consider curriculum-based measurement to be a better way to measure student achievement (Stecker & Fuchs, 2000). Wedl (2005) contended that using standardized tests to evaluate RTI is not as valid as the use of Curriculum-based measurements. Additionally, Wedl noted that high-stakes tests are not sensitive to measuring change and are not good indicators of student growth. Deno (1985) described the Curriculum-based measurements model as being effective in evaluating student growth and determining the effectiveness of instruction. If testing to determine how students perform relative to district and state standards is an important part of NCLB, it will remain a reality for public education. However, Deno recommended that schools use multiple methods of evaluation before labeling RTI a success or failure, keeping in mind that the goal is individual student achievement or growth.

The third recommendation is that schools wishing to implement RTI develop a system to maintain fidelity of the system. In retrospect, this study failed to take into account the fidelity at the RTI school. As a result, there is no certainty that the interventions were implemented as designed. According to Kovaleski, Gickling, and

Marrow (1999), intervention integrity is an "important methodological concern in both research and practice because treatment integrity data are essential to making valid conclusions regarding treatment outcomes" (p. 445). Administrators implementing RTI need to consider the warning of Schmoker (1999) who emphasized teachers are confronted with "initiatives du jour," and unless there is explicit monitoring of implementation and some kind of reward for those who implement the initiatives, teachers do not do so (p. 2). The researcher recommended, therefore, that schools wishing to implement RTI use a method to determine intervention fidelity. Sheridan, Swanger-Gagne, Welch, Kwon, and Garbacz (2009) suggested the use of teacher self-report surveys, interviews, and frequent classroom observations to capture fidelity. However, Lane, Kalberg, Bruhn, Mahoney, and Driscoll (2008) warned in their study that teacher self-reports suggested higher levels of program fidelity than direct observations and principal observations. Researchers Johnson, Mellard, Fuchs, and McKnight (2006) emphasized how critical it is to know if the interventions are being implemented as designed so that if RTI is unsuccessful, schools can take appropriate measures to remedy the deficiency rather than abandoning the entire reform.

Future Research Considerations

In light of the findings from this study, the researcher recommends that the following studies be considered. First, when comparing RTI schools and non-RTI schools, a study could include fidelity of implementation issues along with RTI participation on student achievement. The study could consist of quantitative and qualitative components where the qualitative components richly describe how educators are implementing RTI in their classrooms. In addition, some type of integrity survey tool could be used to measure the level of fidelity. Quantitative measures, including both Curriculum-based measurements and achievement test results, would be beneficial.

Another consideration involves investigating various types of content-specific intervention strategies that effectively move at-risk students toward reaching grade level. Research that focuses on the identification of effective Tier II interventions for mathematics at the secondary level would be helpful to the RTI school as well as other schools wishing to implement RTI.

Next, it may be helpful to broaden the focus of future studies. This study was limited to two schools in a rural setting. With such a narrow focus, the research data may be difficult to generalize to secondary settings with different population demographics. For example, the RTI school in this study was only involved in the tiered framework for 2 years prior to testing. A research study that involves a wider selection of RTI sites with a longer duration of intervention strategies would be helpful.

Finally, this study only looked at RTI participation as it relates to student achievement. Future studies of RTI participation are recommended that focus on other types of data such as discipline, grade retention, special education referral rates, and dropout rates. Research showed support for the contention that RTI reduced special education referrals (Marston, 2001; Tilly, 2003), decreased the numbers of grade retentions (Kovaleski, Tucker, & Duffy, 1995), reduced the dropout rate (Barton, 2008), and improved students' adaptive behaviors (Reschly & Starkweather, 1997).

The findings in this study are similar to those of Burns, Klingbeil, and Yesseldyke (2010) who reported that more research is needed to determine the effects of intervention on standardized test scores. Therefore, educators who wish to implement RTI models at the secondary level would benefit from additional research, as will students who struggle with learning.

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Appendix

Appendix A

Status of Request for Exemption from IRB Review

HARDING
UNIVERSITY
INSTITUTIONAL REVIEW BOARD

Status of Request for Exemption from IRB Review

(For Board Use Only)

Date: 9/4/13

Proposal Number: 2013-084

Title of Project: The Effects of Response to Intervention on Academic Achievement in High School Literacy and Mathematics

Principal Investigator(s) and Co-Investigator(s): Scott Embrey scott.embrey@badger.k12.ar.us

■ Research exempted from IRB review.

□ Research requires IRB review.

□ More information is needed before a determination can be made. (See attachment.)

I have reviewed the proposal referenced above and have rendered the decision noted above. This study has been found to fall under the following exemption(s):

1 □ 2 □ 3 □ 4 ■ 5 □ 6 □

In the event that, after this exemption is granted, this research proposal is changed, it may require a review by the full IRB. In such case, a ***Request for Amendment to Approved Research*** form must be completed and submitted.

This exemption is granted for one year from the date of this letter. Renewals will need to be reviewed and granted before expiration.

The IRB reserves the right to observe, review and evaluate this study and its procedures during the course of the study.

Rebecca O. Weaver

Chair
Harding University Institutional Review Board