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Effects of Computer Assisted Tier II Interventions by Gender on Math and Reading Achievement for Remediated Students

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EFFECTS OF COMPUTER ASSISTED TIER II INTERVENTIONS BY GENDER ON MATH AND READING ACHIEVEMENT FOR REMEDIATED STUDENTS

by

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Dissertation

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DEDICATION

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ABSTRACT

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Title: Effects of Computer Assisted Tier II Interventions by Gender on Math and Reading Achievement for Remediated Students (Under the direction of Dr. Michael D. Brooks)

Response to Intervention (RtI) is a current reform initiative being examined by educators, politicians, and proponents of differentiated education. RtI has tiers of intervention designed to meet the various academic needs of all students. RtI has been developed as an educational methodology to increase student achievement through various problem-solving techniques, through the implementation of specific interventions based on each student's individual needs, and through data-based decision making regarding the interventions used. The implementation of RtI requires schools to shift current educational paradigms of how services are delivered to students.

This quantitative causal comparative study compared the effectiveness of PLATO alone, a computer-assisted instructional program, as a reading and math intervention to the combination of PLATO and differentiated instruction provided by a highly qualified teacher for fifth and sixth grade students. The study took place at two intermediate schools (grades 5 and 6) within a suburban school district in the central region of Arkansas. Fourteen intact Tier II intervention classrooms were identified to participate in the study, two at each school. Classrooms were selected because they were composed of

students who were classified as being at-risk due to not scoring proficient or barely scoring proficient on the 2010 ACTAAP Augmented Benchmark Exam. Students within the classrooms were selected by stratified random sampling to ensure the overall populations as well as subpopulations of race and genders were represented.

A 2 x 2 factorial analysis of covariance was conducted to investigate each of the four hypotheses. The covariates were the math and reading scaled scores on the previous year's ACTAAP Augmented Benchmark Exam. The independent variables were type of instruction and gender, and the dependent variables were math and reading achievement measured by the scaled scores on the 2011 ACTAAP Augmented Benchmark Exam.

This study found no significant interaction effects between type of instruction and gender in the four hypotheses. However, type of instruction as a main effect was significant in three of the four hypotheses. PLATO combined with a highly qualified teacher was more effective on math achievement for both grade levels and on reading achievement for at-risk fifth graders. Gender was a significant main effect in fifth grade reading with the female students scoring higher than the male students did. Within the sixth grade reading groups, although the PLATO with the highly qualified teacher group did score higher than the PLATO alone group did, the result was not significant. Therefore, the overall results of this study indicated the addition of a highly qualified teacher to the PLATO, CAI intervention, significantly improved at-risk students' achievement for these fifth and sixth grade students within Central Arkansas.

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CHAPTER I

INTRODUCTION

When students enter school each fall, most lack the necessary skills to master the grade level in which they enroll. At this point, the assumption is that highly qualified teachers use best practices to meet the needs of students with differentiated instruction. Highly qualified teachers are necessary to the instructional process from the very beginning. Even with differentiated instruction, however, some students do not reach proficiency in those skills. At this juncture, a problem solving team made up of educational professionals usually meets to determine if these students should receive more specialized intervention plans. If the team determines students need additional support, the students are assigned to a more specialized smaller group instruction targeted to meet skills the students lack to be proficient in that grade level. The assignment to the smaller group is often done in addition to the general differentiated instruction that qualified teachers provide. This entire process is guided by recent legislation and reauthorization at the federal level.

With the best instruction from highly qualified teachers, some students will not meet the expected skill level needed because of two main reasons. First, students may experience an educational disadvantage, typically a result of literacy/numeracy deprivation because of poverty or from 2 or more years of inadequate instruction. Second, they may possess a learning disability in the areas of literacy and/or math.

Federal laws have directed schools to focus on assisting students by addressing problems early before students' academic difficulties warrant referrals to special education. Specifically, these laws include the No Child Left Behind Act of 2001 (NCLB) and the reauthorization of the Individuals with Disabilities Education Improvement Act of 2004 (IDEA). When Congress reauthorized IDEA, the law was changed regarding the identification of children with specific learning disabilities (United States Department of Education [USDOE], 2010). As a result, schools had to document a discrepancy between students' achievement level and their intellectual capabilities. After this legislation, however, schools were "not required to take into consideration whether a child has a severe discrepancy between achievement and intellectual ability" (Wright & Wright, 2007, p. 24). Due to this reauthorization, interventions can occur more quickly and can be implemented for any student scoring below proficient in any academic content area. Both IDEA and NCLB underscore the importance of providing high quality, scientifically-based instruction for all students. For students who need more than the initial quality instruction, legislation holds schools accountable for the progress of all students in terms of meeting grade level standards through more focused interventions (NCLB, 2002; IDEA, 1990).

For students needing intensified interventions, the National Center on Response to Intervention (2010) asserted NCLB led to tiers of remediation called the Response to Intervention (RtI) model. The RtI process enables each school to support different levels of intervention to determine academic challenges for individual students as quickly as possible and to remediate based upon the level of academic assistance needed. As a result, teachers utilize scientifically-based instructional methods to promote differentiated learning experiences and academic success for all students within all content areas. The reauthorization of NCLB in March 2011 placed a stronger emphasis on RtI by creating a new definition for institutions not performing at a satisfactory level and by focusing on those schools for academic improvement (Ross, 2011). In a White House press release in March, 2011, President Obama said he would, "focus on the schools and the students most at-risk and ensure the schools have the resources to persistently aid low performing schools and ensure the most effective teachers serve the students most in need" (Obama, 2011, para 1). Although he was not addressing RtI specifically, his focus empowered schools to highlight interventions that assist students in meeting grade level expectations as well as monitor data to ensure the tiers of RtI aid students' academic progress.

One such intervention approach used in schools is computer-assisted instruction (CAI). CAI offers a wide range of programs needed to remediate students quickly and accurately. When a highly qualified teacher facilitates CAI lessons, students can work on areas of weakness and receive specific interventions needed for each conceptual weakness (Cole, 2008). Milner (1979) noted the use of CAI is an intervention that has the potential for improving and enhancing the educational process. This improvement in the design of intervention, remediation, and enhancement sets the foundation for improvement in student academic achievement. Milner noted CAI supports effective instruction using periodic, standards-based assessments to measure student learning, thereby, enabling educators to develop future learning goals and standards. Ideally, technology and CAI should include a wide range of learning strategies educators could apply for differentiated instruction.

Programmed Logic for Automated Teaching Operations (PLATO) is a computer software program, which uses formal assessments, data analysis, and remediation exercises based upon data to enable teachers to monitor students' progress through the tiers of intervention (PLATO, 2010). PLATO is used as a CAI Tier II intervention by the schools within this study for students scoring below proficient on the Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) Augmented Benchmark Exam. PLATO Learning claims to equip educators and empower learners to meet their shared goal of improved student achievement by allowing the educator to customize lessons for the academic needs of students (PLATO, 2001). All PLATO learning courses are aligned to Common Core, state, and national standards (PLATO, 2011).

Statement of the Problem

The purpose of the study was four-fold. First, the purpose of this study was to determine the effects by gender of the instructional use of a combination of an online computer-assisted instructional program (PLATO) and small group instruction versus the online program only on math achievement measured by the 2011 ACTAAP Augmented Benchmark Exam for fifth grade students in two suburban schools in Central Arkansas, after controlling for math achievement on 2010 ACTAAP Augmented Benchmark Exam. Second, the purpose of this study was to determine the effects by gender of the instructional use of a combination of an online computer-assisted instructional program (PLATO) and small group instruction versus the online program only on math achievement measured by the ACTAAP Augmented Benchmark Exam for sixth grade students in two suburban schools in Central Arkansas, after controlling for math achievement on 2010 ACTAAP Augmented Benchmark Exam. Third, the purpose of this study was to determine the effects by gender of the instructional use of a combination of an online computer-assisted instructional program (PLATO) and small group instruction versus the online program only on reading achievement measured by the ACTAAP Augmented Benchmark Exam for fifth grade students in two suburban schools in Central Arkansas, after controlling for reading achievement on 2010 ACTAAP Augmented Benchmark Exam. Fourth, the purpose of this study was to determine the effects by gender of the instructional use of a combination of an online computer-assisted instructional program (PLATO) and small group instruction versus the online program only on reading achievement measured by the ACTAAP Augmented Benchmark Exam for sixth grade students in two suburban schools in Central Arkansas, after controlling for reading achievement on the 2010 ACTAAP Augmented Benchmark Exam.

Background

History and Laws Pertaining to Interventions

President G. W. Bush signed the Individual with Disabilities Education Act (IDEA) into law on December 3, 2004 (IDEA, 1990). Before this revision, educators were encouraged to use the intelligence quotient achievement discrepancy to identify students with learning disabilities and initiate academic interventions for only those who qualified as learning disabled (Resnick, 1979). This revision of IDEA strengthened NCLB by incorporating interventions for all students functioning below grade level in any core subject area rather than only providing remediation for students in special education. NCLB contains four basic education reform principles; which include stronger accountability for results, increased flexibility and local control, expanded options for parents, and emphasis on teaching methods, which have all yielded positive results (Cortiella, 2006).

The accountability for results principle was designed to significantly improve the educational achievements demonstrated by all children with disabilities in areas of academic need (National Center on Educational Outcomes, 2010). NCLB requires schools to demonstrate proficiency and Adequate Yearly Progress according to standards set by state educational departments and approved by the USDOE (National Center on Response to Intervention, 2011). Annual high stakes testing, which measures the academic progress of students, determines Adequate Yearly Progress and proficiency of a school. The USDOE proposes that annual testing allows teachers to respond quickly to problems students are experiencing and address achievement gaps ("No Child Left," 2002).

In addition, the USDOE (2007) asserted that each school district must present disaggregated data on state assessments by demographic subgroups that include: socio-economically disadvantaged students, students with disabilities, students with limited English proficiency, racial and ethnic groups, and gender. The USDOE attempted to rectify distortions and variations masked by the widespread reliance on school wide averages. In the past, states were given the discretion to make exemptions from large-scale state and national assessments. The result was widespread exclusion of students with learning disabilities and students from certain subpopulations. Reasons for such exemptions included a desire to protect students with disabilities from the stresses of testing, an aversion to the difficulties of specialized test administration, a question of whether the students' prior knowledge gave them the ability to understand the testing, and a desire to raise the average scores of a school (Heubert & Hauser, 1998). NCLB includes students with disabilities and limited English proficiency students under its testing and accountability provisions and reinforces prior federal requirements for reasonable accommodations needed to achieve that end (Wenning, Herdman, Smith, McMahon, & Washington, 2000). The current reauthorization of IDEA prompted the development and use of new ways to identify students with learning disabilities by increasing the number and types of interventions occurring within schools. These interventions allowed educators to differentiate between students needing remediation because of educational disadvantages such as poverty or poor instruction and those with true learning disabilities (Learning Disabilities Association, 2005). Therefore, through the increased number of researched-based interventions by incorporating the RtI model, all students are given opportunities to increase academic achievement and reach grade level proficiency.

President Obama (2011) integrated aspects of NCLB and the reauthorization of IDEA within his educational reform, Race to the Top. President Obama articulated key priorities in his education plan, which focused on accountability. The key points the President articulated included the following:

- A fair accountability system that shares responsibility for improvement, rewards excellence, is based on high standards, and is informed by sophisticated assessments, which measure individual student growth
- A flexible system that empowers principals and teachers and supports reform and innovation at the state and local level

- A system focused on the schools and students most at-risk that targets resources and interventions to persistently low performing schools and ensures the most effective highly qualified teachers serve students most in need

President Obama noted, “We need to make sure we’re graduating students who are ready for college and a career. In the 21st Century, it is not enough to leave no child behind. We need to help every child get ahead. We need to get every child on a path to academic excellence” (para. 2). Although not addressing RtI specifically, his key points reflect the purpose of RtI, which allows schools to identify struggling students early and provide appropriate instructional interventions. In addition, NCLB, IDEA, and Race to the Top all emphasize the use of highly effective teachers to provide initial quality instruction as well as to target struggling students with worthwhile interventions. Early interventions by effective teachers increase chances for success and decrease the need for special education services (Wright & Wright, 2007). Posny, director of the federal office of Special Education Programs, cited a 1997 study by Education Trust that examined two groups of students receiving interventions over 3 years (Council for Exceptional Children, 2011). Highly effective teachers instructed one group of students, and ineffective teachers instructed the other group. The first group made academic gains of 76%, and the other lost ground by 27%. Effective teachers were defined by their content knowledge, pedagogy skills, and ability to establish relationships with their students.

Accountability is an integral component of IDEA, NCLB, and Race to the Top. Although other RtI models may be used, a three tiered, leveled model was used in the particular school district used for this study (Wilson, 2008). Interventions within the RtI model can include any scientifically research-based instructional program or method that produces results (Hale, 2006). In the school district under review, the first RtI tier allowed for intensive, differentiated instruction at the classroom level with a highly qualified teacher (Tier I). At the Tier I level of instruction, teachers at the schools included interventions within whole group instruction such as tutoring, use of manipulatives, small group work within the larger group, questioning, and peer tutoring. Tier I interventions aid approximately 80% of students in their academic progress (Response to Intervention, 2006).

If students need more remediation to meet the learning objectives for their particular grade level, the second tier allowed for additional interventions by an area specialist (Tier II). At the Tier II level of intervention, schools used interventions to decrease class sizes and provided more focused and intensive instruction. Examples of Tier II interventions included pullout programs, intervention specialist guidance, small group work focused on specific standards of students' academic difficulties, and CAI that included the PLATO program. These intensive Tier II interventions are designed and implemented to aid 15% of the student population (Response to Intervention, 2006). Students receiving Tier II interventions also received Tier I instruction.

Data determined whether students needed intensive interventions, and the RtI team consisting of the assistant principal, the intervention specialist, the counselor, and the math and language arts core teachers made the decision for Tier III interventions to occur (Hale, 2006). After testing for special education, Tier III interventions were targeted, intensive, and used when students were identified as learning disabled. Students with learning disabilities comprise approximately 5% of the student population, in general (Response to Intervention, 2006). Tier III interventions for this study included special education services and an Individual Educational Plan (IEP) for each student. Students who received Tier III interventions continued to receive Tier I and Tier II interventions.

For the purposes of this study, students who do not meet their individual growth or reach a level of required proficiency were required to complete intensive academic interventions at the Tier II level (Arkansas Department of Education, 2010). RtI Tier II was added to the differentiated teaching methods in the regular classroom and was a means of providing early-individualized intervention to not only LD students, but to all students at-risk of academic failure. Duncan (2011), United States Secretary of Education, stated, “The country is on track to see 82% of the schools labeled as falling below AYP [adequate yearly progress]” (para. 5). Duncan added, “More schools will have to intervene and provide interventions for their students” (para. 15). These interventions will likely be placed under the tiers of RtI.

A critical aspect of the implementation of RtI was the decision making model used in selecting the level or intensity of intervention most appropriate for the learner (Hoover, 2005). With RtI, teachers identify students at-risk for poor learning outcomes, monitor student progress, provide evidence-based interventions, adjust the intensity and nature of those interventions depending on students’ responsiveness, and identify students with learning or other disabilities (Boces & Mellard, 2009). Gresham (2001) stated, “The most serious flaw in the current teaching process is the absence of a direct link between assessment procedures used for identification and subsequent interventions which might be prescribed on the basis of these assessment procedures” (p. 4). The RtI process increases accountability by providing interventions that address assessment data pertaining to adequate yearly progress. Many of these interventions within RtI need to be designed to occur within the framework of solid differentiated learning or instruction, which is individualized for the academic needs of students (Hoover, 2008). Differentiated instruction and RtI share a central goal: to modify instruction until it meets the needs of all learners (Allan & Goddard, 2010). Quality instruction incorporates learning styles and varying academic needs and strengths of each student. The RtI problem solving team works to analyze individual student data from instruction and assessments, to collect more data, and to monitor the progress of struggling students to ensure interventions are working or to determine if more intensive interventions are needed (Response to Intervention, 2006).

Computer-Based Intervention

Technology is an approach many school districts have implemented to improve instruction to aid students in their learning experiences. Kulak and Kulak (1991) noted that since the early 1960s, educational technologists have developed CAI programs to drill, tutor, teach, and test students to manage instructional programs. Kulak and Kulak added, in recent years, schools have used these CAI programs to supplement or replace more conventional teaching methods, especially in the areas of differentiated learning. Bradford (2005) and Gaddy (2007) concluded CAI allows educators to incorporate information and activities into classrooms, which encompass real world issues and individualizes instruction for students.

However, factors that hinder CAI instruction include the lack of professional development for educators, the cost of technology, and the rapid infusion of new technologies that make formerly current technologies obsolete (Partnership for 21st Century Skills, 2004). As a result, the Partnership for 21st Century Skills noted a widening gap has formed between the knowledge and skills students acquired in schools and the knowledge and skills needed to succeed in the 21st century workplace. As a first step toward bridging this gap, NCLB requires states to ensure that "every student is technologically literate by the time the student finishes the eighth grade, regardless of the student's race, ethnicity, gender, family income, geographic location, or disability" (NCLB, 2002, para. 9). Information and communication technology is one of the basic building blocks of modern society. Many countries now regard understanding information and communication technology and mastering the basic skills and its concepts as part of the core of education, alongside reading, writing, and numeracy (Partnership for 21st Century Skills, 2009).

The Partnership for 21st Century Skills (2009) stated information and communication technology literacy reflects the need for students to develop learning skills, which enable them to think critically, analyze information, communicate, collaborate, and problem solve. Technology plays an essential role by helping students realize vital learning skills in today’s knowledge-based society (Kay & Honey, 2005). The North Central Regional Educational Laboratory (2005) suggested students need to have a wide range of skills to communicate effectively, not only via paper and pencil, but also through audio, video, animation, design software, email, web sites, blogs, chat rooms, instant messages, text messages, streaming media, and message boards. Additionally, the North Central Regional Educational Laboratory reported students must also be able to multi-task, work within teams both individually and collaboratively, and prioritize technology applications for future learning. Students should apply prior knowledge and foundationally build upon it to increase understanding and problem solving ability. Students must also be aware of security and legal issues surrounding access to CAI. Students must know and use strategies and gain information to acknowledge, identify, and negotiate 21st century issues surrounding technology.

PLATO (2010) learning uses these information and communication technology skills through high quality content and multimedia presentations. PLATO accommodates various learning styles and academic needs through customized courses and research-based online courses (PLATO, n.d.). Therefore, PLATO Learning (2011) claimed technology information and skill acquisition gained through PLATO could enable students to use this knowledge in both the school setting and in their future careers and lives.

Cognitive skill acquisition has historical roots in the study of problem solving (VanLehn, 1996). VanLehn noted skill acquisition was thought to develop through the cognitive attainment or learning of the following sequence: a single principle or rule, a collection of interacting pieces of knowledge, and finally, a skill. In the final stage, practice was essential in developing speed and accuracy (Hung, Randolph-Seng, Monsicha, & Crooks, 2008). Generally, practice is considered to be an important factor in the automation of cognitive, affective, and behavioral learning with practice promoting faster knowledge application and increased response accuracy and motivation (Moors & De Houwer, 2006). Computer-based lessons engage students in the learning process with independent practice of standards (Frederick & Shaw, 1998). CAI presents teachers with a medium that is used to present information, give practice of a wide range of standards, and encourage the acquisition of knowledge to a wide spectrum of students (Jackson, 2008). Thus CAI, if delivered appropriately, correlates the instructional strategy/activity with the standards of each grade level and individualizes instruction for each student.

In standards-based education, effective instruction depends on adequate and consistent alignment of standards, benchmarks, assessment, and instruction. Thus, educators are encouraged to implement strategies for continuous improvement, curriculum alignment, professional development, and evaluation (PLATO, 2010). The PLATO Student Achievement Model encompasses the aforementioned improvement strategies and offers educators a guide to creating individualized academic plans for all levels of students. PLATO Instructional Services (2010) noted the model is a framework that helps to build educator capacity and promoted student learning. It was developed using effective schools research, continuous improvement theory, and school-based action research. PLATO has observed the way technology has adopted into education and continually has monitored how technology is evolving to enable students to not only achieve technology skills, but to achieve those skills within an academic content (PLATO, 2008).

Studies on the Use of Computer-Assisted Instruction for Intervention

With the passage of the NCLB legislation in January 2002, assessment has become more high stakes, more routine, and more focused on specific content knowledge (Honey, 2004). Assessment data has been used regularly for student proficiency at grade level as well as a gauge for evaluating teachers, schools, and school districts. Therefore, efforts to integrate technology into schools and classroom practices must not only acknowledge but also provide evidence that technology assists in meeting states' and

USDOE's accountability demands (Cromey & Hanson, 2000). Greater emphasis placed on high stakes testing has prompted greater scrutiny on what is being tested and how it relates to what students need to know to succeed in society (Honey, 2004). Therefore, technology used in an educational setting must incorporate the standards being taught, provide a way to assess student learning, and provide data to the teacher in a timely manner to aid in furthering academic achievement (North Central Regional Educational Laboratory, 2004). Without internet access, schools would not be able to implement many forms of CAI. However, in the fall of 2001, 99% of public schools in the United States had access to the internet (National Center for Educational Statistics, 2009a).

Past research for CAI has provided evidence of a positive association between student achievement and CAI. In their meta-analysis review of research conducted between 1993 and 2000 on the effectiveness of CAI, Murphy, Penuel, Means, Korbak, and Whaley (2001) found evidence of a positive association between the use of CAI and student achievement in reading and mathematics. This association was consistent with earlier reviews of the research literature on the effectiveness of computer-based instruction (Fletcher-Flinn & Gravatt, 1995; Kulak, 1994; Kulak & Kulak, 1991; Ryan, 1991). Studies showed that when students receive intensive, comprehensive instruction from scientifically research-based CAI programs, they make significant improvements in reading achievement (Scholastic, 2002, 2004b).

In a study commissioned by the Software and Information Industry Association, Sivin-Kachala and Bialo (2000) reviewed 311 research studies on the effectiveness of technology on student achievement. Their findings revealed positive and consistent patterns when students were engaged in technology rich environment. Included were significant gains and achievement in math and reading academic areas, increased achievement in preschool through high school for both regular and special needs students, improved attitudes toward learning, and increased self-esteem.

In examining large scale state and national studies, as well as some innovative smaller studies on newer educational technologies, Schacter (1999) found that students who have access to any of a number of technologies showed positive gains in math and reading achievement on researcher constructed tests, standardized tests, and national tests. In these studies, technologies included CAI, integrated learning systems, simulations and software that teach higher order thinking, collaborative networked technologies, and/or design and programming technologies. Research indicated computer technology can help support learning and is especially useful in developing higher order skills of critical thinking, analysis, and scientific inquiry in the areas of math and reading "by engaging students in authentic, complex tasks within collaborative learning contexts" (Roschelle, Pea, Hoadley, Gordin, & Means, 2000, p. 81).

Some studies such as the READ 180 study incorporated both teacher and technology assisted instruction (Goin, Hasselbring, & McAfee, 2004). READ 180 addresses the needs of students of varying backgrounds and abilities through a multifaceted and comprehensive array of instructional components including a combination of CAI, whole and small group teacher led instruction, and independent reading of high interest books. READ 180 has been proven effective with all types of struggling older readers including English Language Learners and those receiving special education services (Scholastic, 2004a).

Tell (2010), Instructional Technology Specialist/PLATO Administrator, conducted a case study of a Central Arkansas school district using PLATO as a Tier II CAI for student math and reading achievement. During the 2006–2007 school year, the school district extended the PLATO Learning program to serve students in grades 5–8. As part of this implementation, the district capitalized on its vertical and horizontal alignment by implementing Arkansas state frameworks and its use of pacing guides to ensure consistency across grade levels and subjects. The district incorporated PLATO Learning's curriculum and assessment Arkansas alignment, which was embedded within PLATO learning pathways. The district also took advantage of the flexibility of the system in creating custom learning options. Students accessed individualized learning paths and practiced modules that were aligned to their achievement levels on the pretest. This instruction was customized to match the pacing guides of the district and addressed essential objectives in mathematics and literacy. Between 2007 and 2009, the growth in student math and reading achievement between the comparable pretests and posttests ranged from 48% to 90% with an average growth of approximately 70% for grade level math and reading tests.

Hypotheses

The brief review of literature indicated positive results concerning the effects of CAI on student achievement in math and reading. In addition, the review of the literature also indicated positive results concerning Tier II interventions on student achievement in math and reading. However, the evidence specifically related to PLATO as a CAI, Tier II intervention on student achievement in the areas of math and reading was minimal. Therefore, the researcher generated the following null hypotheses:

1. After controlling for math achievement on the 2010 ACTAAP Augmented Benchmark Exam, no significant difference will exist by gender between fifth grade students in two intermediate schools within a suburban school district in Central Arkansas who were exposed to a combination of an online computer-assisted instructional program (PLATO) and small group instruction versus those who were exposed to the online program only on math achievement measured by the ACTAAP Augmented Benchmark Exam.
2. After controlling for math achievement on the 2010 ACTAAP Augmented Benchmark Exam, no significant difference will exist by gender between sixth grade students in two intermediate schools within a suburban school district in Central Arkansas who were exposed to a combination of an online computer-assisted instructional program (PLATO) and small group instruction versus those who were exposed to the online program only on math achievement measured by the ACTAAP Augmented Benchmark Exam.
3. After controlling for reading achievement on the 2010 ACTAAP Augmented Benchmark Exam, no significant difference will exist by gender between fifth grade students in two intermediate schools within a suburban school district in Central Arkansas who were exposed to a combination of an online computer-assisted instructional program (PLATO) and small group instruction versus those who were exposed to the online program only on reading achievement measured by the ACTAAP Augmented Benchmark Exam.
4. After controlling for reading achievement on the 2010 ACTAAP Augmented Benchmark Exam, no significant difference will exist by gender between sixth

grade students in two intermediate schools within a suburban school district in Central Arkansas who were exposed to a combination of an online computer-assisted instructional program (PLATO) and small group instruction versus those who were exposed to the online program on reading achievement measured by the ACTAAP Augmented Benchmark Exam.

Description of Terms

Academic student improvement plan. An academic student improvement plan is a plan developed for each student not performing at the proficient level on any portion of Arkansas's criterion-referenced tests (Arkansas Department of Education/Testing, 2010). This plan contains a detailed description of interventions and remedial instruction used in addressing the areas of deficiency of the student.

At-risk student. At-risk students are students who are not experiencing success in school and are potential dropouts (At-Risk Students Law & Legal Definition, 2010). By definition, these students are low academic achievers who exhibit low self-esteem and are from low socioeconomic status families. At-risk students tend not to participate in school activities, have a minimal identification with the school, and have disciplinary and truancy problems. They usually exhibit impulsive behavior, and their peer relationships are problematic. Family problems, drug addictions, pregnancies, and other problems prevent them from participating successfully in school. As they experience failure and fall behind their peers, school becomes a negative environment that reinforces their low self-esteem.

Computer-assisted instruction (CAI). CAI encompasses instruction, remediation, and/or enrichment using a computer or computerized program (North Central Regional Educational Laboratory, 2005).

Differentiated instruction. Differentiated instruction occurs when teachers plan varied approaches depending on student individual learning needs. Teachers must consider diversity of learning styles and the different strategies and expressions in which students demonstrate knowledge (Duran & Diamond, 2010). Differentiated instruction is performed to enable all students to reach their highest academic potential.

Individualized Education Plan (IEP). An IEP is a legal document defining what special education services a learning disabled student receives as a Tier III intervention. Teachers make decisions about instruction and placement of students in intervention and enrichment based upon data from formal and summative assessments (Duran & Diamond, 2010). The IEP includes placement, services, and academic and behavioral goals for each student as well as the amount of time the student will spend in special education services.

Intervention. Interventions are systematic attempts by educators to provide research-based support geared toward each student's academic needs to enable him or her to exceed grade level expectations (Duran & Diamond, 2010). Interventions are provided in addition to regular classroom instruction.

Intervention specialist. For the purposes of this study, an intervention specialist is an educator who works with students at the Tier II level of RtI to provide more specialized and individualized interventions in effort to help students reach or exceed grade level expectations in core academic subjects (Arkansas Department of Education/Testing, 2010).

Levelized learning. Levelized learning is learning from instruction based upon the academic level of each student that allows for academic success and growth until each student meets grade level expectations (Duran & Diamond, 2010).

Performance levels. The Arkansas Department of Education/Testing (2010) categorizes four levels of student achievement on the state's criterion-referenced exams. The four levels are advanced, proficient (grade level), basic and below basic. The levels are described as follows:

- **Advanced**. Advanced students demonstrate superior performance level well beyond grade level standards performance. Advanced students can apply established reading, writing, science, and mathematics skills to solve complex problems and complete demanding tasks individually. Advanced students make insightful connections between abstract and concrete ideas and provide well supported explanations and arguments.
- **Proficient**. Proficient students demonstrate solid academic performance level for grade level standards tested and are well prepared for the next level of schooling. Proficient students can use established reading, writing, and mathematics skills and knowledge to solve problems and complete tasks individually. Proficient students can tie ideas together and explain the ways their ideas were connected.
- **Basic**. Basic students show substantial skills in reading, writing, and mathematics for grade level standards; however, basic students only partially

demonstrate the abilities to apply these skills and do not always tie ideas together or explain how ideas were connected.

- **Below Basic**. Below basic students fail to show sufficient mastering of skills on grade level standards in reading, writing, and mathematics. Below basic student work demonstrates a lack knowledge and problem solving ability.

Programmed Logic for Automated Teaching Operations (PLATO). PLATO (PLATO, nod) is a computer-assisted instructional network developed in the 1960s by Don Bitzer. Its purpose is to provide intervention, instruction, and enrichment to meet the diversified academic needs of the population of a school. Prescriptions are lessons in PLATO assigned to students when they miss a question on the released item PLATO Benchmark test. Lessons are correlated with the standard missed and are assigned automatically to students so they receive interventions based on the standard in which they are not meeting grade level expectations.

Response to Intervention (RtI). For the purposes of this study, a three tiered, levelized model was used (Wilson, 2008). RtI is a model that integrates assessment and intervention within a multi-level prevention system to maximize student achievement and to reduce behavior problems (Duran & Diamond, 2010). With RtI, schools are able to provide a quality instruction and identify students at-risk for poor learning outcomes. As a result, student progress is continually monitored through the use of evidence-based interventions. These interventions are also monitored and adjusted depending on the responsiveness of the students. During this process, students are also identified if they are thought to possess a learning disability.

Student learning expectation. A student learning expectation is a specific learning objective to be introduced, taught, and mastered within a content standard for a specific grade level (Arkansas Department of Education/Testing, 2010).

Significance

Research Gap

In general, factors contributing to learning using CAI have been well established in the literature. However, evidence specifically related to PLATO as a CAI, Tier II intervention on student achievement in the areas of math and reading is minimal. In addition, a lack of data-based research exists showing the impact of CAI combined with quality teacher instruction. Although some may believe that CAI is a standalone solution to remediation problems, the EFA Global Monitoring Report (2005) noted that learning through performance requires active discovery, analysis, interpretation, problem solving, memory, and physical activity. This type of instruction still seems to require the combination of CAI strategies and high quality teacher instruction. This mode of instruction aids in cognitive learning and helps students in the direction of creative and emotional development. Experienced, highly qualified teachers deliver many subtle messages and important lessons in such classrooms that might be diminished in other types of learning (Donlevy, 2003; USDOE, 2006). In addition, Donlevy (2003) reported students with low reading abilities and problems with motivation may find it difficult to sustain interest in accomplishing all learning activities associated with other types of learning without including teacher direction. Therefore, Donlevy proposed that a superior figure should exist to monitor the progress of students and guide them every step of the way.

Nonetheless, research gaps on the effectiveness of educational technology on student learning depend not only on academic outcomes, but also on how technology is integrated into instruction and how teachers assess student performance and adjust instruction accordingly (Fulton, 1998). The connection of teacher assisted instruction and CAI to provide a stronger instructional strategy for Tier II remediation has not been studied. A lack of data-based research exists showing the impact of CAI on various types of students, particularly remediated students (Traynor, 2003). Adams (2009) stated that especially for struggling readers, it is important to ensure a good match between reader and text. Although PLATO does enable specific lessons to be fitted for individual student needs in all content areas, this has not been researched as a Tier II intervention (PLATO, 2008). A lack of research also exists from schools determining if the instruction they are providing as part of a RtI three tiered system of support is effective in meeting the academic needs of all students (Wheeler, 2010). Scholastic Read (2006) suggested that readers in CAI demonstrate gains, often substantial, in reading on standardized tests such as the Stanford Achievement Test-9, TerraNova, and the Scholastic Reading Inventory. However, Tienken and Maher (2005) suggested the empirical literature on CAI and middle school mathematics achievement is insufficient and the results are mixed. Tienken and Maher also stated the CAI program failed to improve the performance of the neediest students of the district.

Possible implications for Practice

This study will provide quantitative research on the effects of PLATO as a Tier II intervention for at-risk students combined with a highly qualified teacher on both math and reading achievement of fifth and sixth grade students scoring below proficient on the

ACTAAP Augmented Benchmark Exam. This study provides educators with additional resources to improve Tier II intervention for at-risk students in both math and reading achievement. Data accumulated in this study add to the body of evidence on the usefulness of Tier II intervention practices and CAI. Data collected during this study will also provide documentation of the consistency and validity of the effect of PLATO as a CAI intervention on student achievement. The results of this study provide information on PLATO as a CAI to further both differentiated instruction as well as Tier II interventions.

Process to Accomplish

Design

A quantitative causal comparative study was conducted at two intermediate schools in a suburban school district in Central Arkansas with a population of approximately 800 students at each school. For the hypotheses, four 2 x 2 factorial analyses of covariance (ANCOVAs) were used. The independent variables for all four hypotheses were type of instructional Tier II intervention (a combination of an online CAI program called PLATO and small group instruction versus the online program only) and gender (male versus female). The dependent variable for Hypotheses 1 and 2 was math achievement for fifth and sixth graders, respectively. The dependent variable for Hypotheses 3 and 4 was reading achievement for fifth and sixth graders, respectively.

Sample

The study took place during the 2010-2011 school year. The study used fifth and sixth grade students from two intermediate schools from a suburban Central Arkansas school district. The two schools were chosen based on their similar student demographics of grade configuration and ethnicity and the teachers on average had the same years of experience and education. Each of the two intermediate schools had an approximate population of 800 students. Classes consisted of approximately 24 students each. Of the participants in both schools, approximately 56% were male and 44% were female. Approximately 61% of students were Caucasian, 25% were African American, 10% were Hispanic, 3% were Asian, and 1% was Native American. The socioeconomic status of the two schools differed. In one school, 35% of the students received free or reduced price lunches, whereas in the other school, 64% of the students received free or reduced price lunches. However, the two sample groups involved in this study were similar with regard to socioeconomic status. The socioeconomic percentage of students receiving free or reduced price lunches involved in this study was 33% and 37%, respectively.

Fourteen intact Tier II intervention classrooms in the two intermediate schools were identified to participate in the study (seven from each school). Classrooms were selected because they were comprised of students who did not score proficient on the ACTAAP Augmented Benchmark Exam. These classrooms consisted of approximately 180 students who scored basic or below basic on the 2010-2011 ACTAAP Augmented Benchmark Exam. Students within the classrooms were selected by stratified random sampling to ensure the overall populations, as well as subpopulations of race and gender, were represented.

Instrumentation

The ACTAAP Augmented Benchmark Exam is a combined norm reference and criterion reference formal assessment designed by Questar Assessment, Inc. (Arkansas Department of Education/Testing, 2010). This test was administered at the end of the spring semester of the 2009-2010 and the 2010-2011 school years using standardized testing procedures. The ACTAAP Augmented Benchmark Exam measures mathematical and reading achievement. The mathematics subtest measured students' ability to compute problems within each of the National Council of Teachers of Mathematics mathematical strands: number sense and operations; algebra; geometry; measurement; and data analysis and probability. Literacy comprehension, grammar, and writing skills were measured by the language arts subtest. Both the language arts subtest and the mathematics subtest consisted of multiple choice (used for this study) and open response questions. The language arts section also contained an essay writing section (not used in this study). Scaled scores from the ACTAAP Augmented Benchmark Exam were used to measure mathematics and reading achievement. The scale scores (used for this study) correspond to levels of proficiency standards set by the Arkansas Department of Education, which include Advanced, Proficiency, Basic, and Below Basic.

Students completed the ACTAAP Augmented Benchmark Exam for the 2009-2010 school year. Students then received interventions utilizing one of the two instructional conditions within the study. At the end of the spring semester of the 2010-2011 school year, the ACTAAP Augmented Benchmark test was administered to all students.

Data Analysis

Data for the 2009-2010 and 2010-2011 school year were collected. The data from the 2009-2010 ACTAAP Augmented Benchmark test was used as a covariant to ensure a starting point for students' academic growth. Appropriate statistical tests were conducted to support or not support the formulated hypotheses.

To address the first and second hypotheses, two 2 x 2 factorial ANCOVAs were conducted using type of intervention and gender as the independent variables and math achievement as the dependent variable for fifth and sixth grade students, respectively. To address the third and fourth hypotheses, two 2 x 2 factorial ANCOVAs were conducted using type of intervention and gender as the independent variables and reading achievement as the dependent variable for fifth and sixth grade students, respectively. The covariates used for all the hypotheses contained data from the previous year's Benchmark tests in either math or reading. To test the null hypotheses, a Bonferonni adjustment was used to modify the alpha level from .05 to .0125 to correct for alpha inflation to help control for Type 1 errors because of the multiple tests. RtI teams met to discuss and analyze data of students not achieving proficiency. Upon examination of multiple data sources, students continued receiving Tier II interventions or were determined to be in need of the more intensive Tier III interventions.

CHAPTER II

REVIEW OF THE RELATED LITERATURE

Educators continually need to teach in ways that bring meaning and relevancy for the students who receive their instruction. However, methods that bring relevancy to one group of students may not bring relevancy to another group. This review of literature addresses a variety of issues regarding low achieving students and the paradigm shift that RtI, the focus on this process with its Federal and State legislation, has engendered. First, a brief history of instruction and problems requiring intervention is presented. Second, a brief legal history of legislation pertaining to the need for intervention is offered. Third, types of academic interventions including Scholastic's Read 180 and the PLATO program are examined. Fourth, this chapter addresses how the district under examination is using the PLATO software program as a Tier II instructional method. Finally, conclusions are drawn from this review.

History of Academic Intervention

Research on educational interventions for students exhibiting learning difficulties began in the 1960s and was based on the process-to-treatment approach (Vaughn & Linan-Thompson, 2006). The premise of the process-to-treatment approach draws on the theory of remediation introduced by Kirk (1962). Kirk theorized it was possible to identify students' individual educational strengths and weaknesses through intensive diagnostic testing in order to develop differentiated individualized treatment programs.

This theory of remediation was founded on two major assumptions. First, quality instructional practices can remedy low achievement resulting from educational disadvantages. Second, either students identified with learning disabilities or processing issues require supplemental instruction (Vaughn & Linan-Thompson, 2006). The theory provides significant historical perspective with regard to the identification of learning disabilities because it initiated the development of assessment tools and remediation techniques as well as influenced concepts and language used in the Individuals with Disabilities Education Act (IDEA) to define specific learning disabilities (Hallahan & Mercer, 2002; Vaughn & Linan-Thompson, 2006).

General Issues Leading to Intervention

Although there is some agreement in the identification of students with learning problems, conflicting viewpoints exist regarding how to remediate low achieving students and students with learning disabilities, which is relevant to RtI. Even though characteristics of low achieving students and students with learning disabilities students are often similar, they can be perceived differently. Some researchers think low achieving students would benefit from services such as early intervention, small class size, direct and intense instruction, or even additional support in the general education classroom (Al Otaiba & Fuchs, 2006). However, others emphasize the expense involved in providing additional support services and developing criteria for qualified students; these types of issues contribute to the discord and debate (McDermott, Goldberg, Watkins, Stanley, & Glutting, 2006).

Since the publication of *A Nation at Risk* in 1983, states, local districts, and the federal government have been focused on how to modify public school instruction to improve student academic performance. In addition, in this era of high stakes testing, academic achievement is the critical topic of concern for administrators, guidance counselors, teachers, parents, and especially students themselves (Scanlon, Gelzheiser, Vellutino, Schatscheider, & Sweeney, 2008). Recent National Assessment of Educational Progress (2003) data indicated 68% of fourth graders and 70% of eighth graders in public schools nationally perform at or below the basic level in reading comprehension. Data also indicated 60% of fourth graders and 65% of eighth graders in public schools perform at or below the basic level in mathematics problem solving (National Center for Education Statistics, 2009b). The individual gains in performance of only a few targeted students, especially the low achieving students, could have profound and positive effects on the schools' overall academic achievement level (Scanlon et al., 2008). The RtI model was developed to implement a system for all students to improve their educational achievement, not excluding the low performing students (Fuchs & Fuchs, 2006).

A key finding from the literature included the idea that academic achievement for students at-risk of failure as well as their typically achieving peers can be improved with targeted instruction using individualized lessons on areas of academic weakness (Faggella-Luby & Deshler, 2008). Because RtI is not a one dimensional approach to improving student outcomes, it can provide numerous evidence-based practices, which can be employed to improve student learning. This multi-dimensional feature makes RtI a valuable model because of its potential for building the capacity of schools to meet the learning needs of an increasingly diverse student population (Johnson, Mellard, Fuchs, & McKnight, 2006). Despite extensive diversity in schools, two primary reasons continually surface regarding student proficiency in required grade level skills. First, some students have an educational disadvantage that is typically a result of literacy/numeracy deprivation because of poverty or 2 or more years of inadequate instruction. Second, some students have a learning disability that hinders their progress in the areas of literacy and math.

Swigart (2009) identified factors that contribute to educational disadvantages leading to poor academic performance including (a) a deficiency of content understanding, (b) a limited understanding or exposure to content vocabulary, (c) a deficiency of prior knowledge, (d) a deficiency of knowledge on specific student learning expectations, (e) poor instructional methods, (f) a deficiency of effective listening skills, (g) a deficiency of parental support, and (h) a lower socioeconomic status. Fuchs and Fuchs (2006) suggested highly qualified educators must identify the factors causing low performance and recognize the need to define what low performing areas must be identified and remediated for each student through differentiated interventions. In addition, identification and remediation must be based upon data, must be done in a timely manner so further remediation is not needed, and must produce positive academic results. Regardless of the reason for the difficulties, specific problems must be identified that lead to more focused interventions.

Students with learning disabilities are often identified when their response to scientifically validated instruction is markedly inferior to that of peers or when children responding poorly to generally effective instruction have a disability that requires specialized treatment (Fuchs & Fuchs, 2006). The IDEA (1990) defined *specific learning disability* as follows:

> Specific learning disability means a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in the imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations, including conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. (para. 10)

Proponents claim that instructional models like RtI have advantages over the discrepancy approach, including a stronger focus on intervention, earlier identification of children with disabilities, and an assessment process with clearer implications for academic programming (Fuchs & Fuchs, 1998). The authors argued the RtI process helps educators differentiate between the two explanations of low achievement: educational disadvantages and learning disabilities.

Specific Problems and Instruction Leading to Intervention

Several types of problems lead teachers to recommend more individualized intervention strategies including print reading and comprehension, dyscalculia, and teacher instruction. First, difficulties with basic print reading and reading comprehension are the most common problems associated with learning disabilities (Gersten, Fuchs, Williams, & Baker, 2001). Because of the strong connection between spoken and written language, reading problems often can be traced to early delays in receptive and expressive language development (Catts, Fey, Zhang, & Tomblin, 1999; Catts & Kamhi, 2005; Scarborough, 2001). Learning Disabilities of America (1998) stated that for at-risk or learning disabled students, the process of learning to read could break down with reading mechanics or comprehension. In addition, students with learning disabilities do not always acquire skills in the normal developmental sequence. If students do not develop adequate phonemic awareness during the pre-reading period, effective decoding may not be possible, which influences the development of fluent reading and comprehension skills. In addition, students with learning disabilities often arrive at the reading task with oral language comprehension problems. Learning Disabilities of America (1998) asserted when assessing and planning for instruction and interventions, consideration of oral language comprehension problems may facilitate acquisition of reading comprehension. Students with learning disabilities should be provided with sound strategic approaches that empower them as readers rather than be allowed to learn and internalize incorrect practices.

Second, dyscalculia involves the inability to understand the meaning of numbers and their quantities (Logsdon, nod). *Dyscalculia* refers to a wide range of lifelong learning disabilities involving math (National Center for Learning Disabilities, 2010). The National Center for Learning Disabilities (2010) stated there is no single type of math disability, and dyscalculia varies from person to person and affects people differently at different stages of life. Logsdon (n.d.) stated students with dyscalculia cannot understand basic operations of addition and subtraction. In addition, they may not understand complex problems such as multiplication, division, and problems that are more abstract. Because students do not understand math concepts, they do not remember and cannot build on them to master problems that are more complex or problem solving skills. The National Center for Learning Disabilities (2010) listed two major areas of weakness that can contribute to math learning disabilities: visual-spatial difficulties and language processing difficulties.

Third, recent studies offer compelling evidence that teachers are one of the most critical factors in how well students achieve (Rice, 2003). Several studies of student gains on standardized tests from 1 year to another have found the teacher to be the most influential factor (Rivkin, Hanushek, & Kain, 2001; Sanders & Horn, 1994; Sanders & Rivers, 1996; Wright, Horn, & Sanders, 1997). Research suggested student achievement is more heavily influenced by teacher quality rather than race, class, prior academic record, or school attended (Approach, Record, & Attend, 2006). Haycock (1998) conducted a study for the Education Trust and found students who have several effective teachers in a row make dramatic gains in achievement, and those who have two ineffective teachers in a row lose significant ground from which they may never recover. Haycock found, "Students who achieve at similar levels in the third grade may be separated by as many as 50 percentile points years later, depending on the quality of the teachers to whom they were assigned" (p. 6). This suggested the most significant gains in student achievement will likely be realized when students receive instruction from high quality teachers over consecutive years (Approach et al., 2006). In addition, research shows teachers who have mastery of their subject matter are more effective in the classroom (Monk, 1994).

The Elementary and Secondary Education Act of 2001(formally identified as No Child Left Behind Act of 2001) and the Individuals with Disabilities Education Improvement Act of 2004 contained requirements related to the qualifications of teachers (NCLB, 2002). The Department of Education (n.d.) described teachers with a deep subject area understanding as highly qualified teachers. The federal definition of a highly qualified teacher included teachers who meet all of the following criteria: hold full certification and/or licensing by the state, holds at least a bachelor degree from a 4-year institution, and demonstrates competence in each core academic subject area in their field. Rice (2003) suggested five broad categories of teacher attributes appear to contribute to teacher quality: (a) experience, (b) preparation programs and degrees, (c) type of certification, (d) coursework taken in preparation for the profession, and (e) individual test scores. Wayne and Youngs (2003) also targeted teacher quality in their analysis of studies that examined the characteristics of effective teachers and their link to student effectiveness. Berry (2002) noted that although these teacher qualities are important, they appear to have a "singular focus on content knowledge" (p. 1). Highly qualified teachers must also know "how to organize and teach their lessons in ways that assure diverse students can learn those subjects…Highly qualified teachers don't just teach well designed, standards-based lessons: They know how and why their students learn…" (p. 2). This knowledge of students is vital in determining interventions for students with educational disadvantages or learning disabilities.

All of these types of problems have led to the enactment of laws that address the specific problems students encounter at school. Because the problems are complex, specifically in the realm of learning disabilities, laws were developed to encompass all the students' needs with the goal of improving academic achievement.

Legislation Pertaining to the Need for Intervention

Federal support for special education services in the United States became a reality in 1976 with the passage of the Education for All Handicapped Children Act of 1975 (Public Law 94-142). Prasse (2002) asserted this law was one of the most influential federal laws affecting the delivery of education services to students with disabilities. This historic legislation contained several mandates including (a) a free and appropriate public education for students with disabilities, (b) an education in the least restrictive environment, (c) due process rights for parents, and (d) access to technically adequate and non-discriminatory evaluation procedures as well as other provisions. Another law that significantly changed the interaction of the regular classroom and special education into more of a single system was the Individuals with Disabilities Education Act (IDEA 97). Although continuing to reinforce important concepts outlined in previous special education legislation, the passage of IDEA 97 also recognized the significance of new issues such as problem solving models for serving students with disabilities (Prasse, 2002). NCLB legislation complemented IDEA 97 by attempting to close the achievement gap between disadvantaged and minority students and their peers (Cortiella, 2006).

No Child Left Behind (NCLB)

In 2002, the NCLB Act, which is the most recent reauthorization of the ESEA, was signed into law. Cortiella (2006) indicated NCLB brought about significant changes in the American educational system. Cortiella argued that since its passage, NCLB has dramatically expanded the role of the federal government in education, demanded accountability of schools, and provided guidelines for meeting accountability standards. Yell, Katsiyannas, and Shiner (2006) pointed out the law requires all students to reach proficiency in math and reading by 2014, and mandatory testing must be performed until 100% proficiency is reached. Kozol (2005) observed these accountability provisions have had a huge impact on schools and have led to complex data collection procedures to measure response to intervention in qualifying students for special education services and increasing pressure on schools to eliminate aspects of the curricula that do not address literacy and math.

Yell, Drasgow, and Lowrey (2005) stated NCLB affects all areas of education but particularly special education in many unique ways. NCLB's provisions for accountability, including mandated adequate yearly progress, statewide assessments, and new standards for curricula and providers, have caused the most changes. They contented NCLB included special education in all aspects of its accountability system in order to make schools accountable to the needs of struggling students and students with disabilities. In fact, NCLB marked the first time federal law clearly mandated that schools should be held accountable for the progress of students with disabilities (Allbritten, Mainzer, & Ziegler, 2004).

NCLB was built upon four principles that emphasize (a) accountability for results, (b) doing what works based upon scientific research, (c) expanding parental involvement and educational options, and (d) expanding local control and flexibility (Cortiella, 2006). Cortiella (2006) stated that to achieve the goal of bringing all students to a proficient level in reading and math by 2014, states are required to implement the following procedures:

- Develop challenging academic standards that are the same for every student
- Develop annual academic assessments for all students
- Ensure there is a highly qualified teacher in every classroom
- Define the amount of academic progress, which school districts and schools must achieve each year in order to reach the proficiency goal by 2014
- Ensure schools and school districts test at least 95% of all students

- Determine a minimum size for required subgroups of students to be included in yearly progress calculations based on technical considerations
- Ensure the availability of reasonable adaptations and accommodations for students with disabilities
- Produce an annual statewide report card of performance and make the report available to the public

Annual statewide assessments of student progress are the centerpiece of the accountability principle of NCLB. Data from these assessments, combined with other important indicators, are used to determine if schools and school districts achieve adequate yearly progress. Building on the standards-based reform efforts put into place under the previous version of ESEA, NCLB sought to raise the academic achievement of all students towards mastering state standards and close the achievement gaps between federally identified student groups.

Individuals with Disabilities Act Reauthorized

In November 2004, IDEA was again reauthorized and renamed the Individuals with Disabilities Education Improvement Act (IDEIA). The reauthorized law expanded on the changes started with IDEA 97 shifting the focus to bringing the regular classroom and the special education program together. The reauthorization addressed the recommendations of many education leaders by removing the reliance on intelligence quotient testing as an identification of children with learning disabilities. In addition, IDEIA removed the requirements of the *significant discrepancy* formula for learning disabilities classification based on intelligence quotient tests and required that states must permit districts to adopt alternative models (Prasse, 2002). The IDEIA 2004 required schools to provide systematic, measured, appropriate educational interventions to students to ensure they have been provided appropriate instruction. RtI is an integrated system of instruction and intervention guided by student outcome data. IDEIA 2004 permitted districts to use as much as 15% of their special education monies to fund intervention activities, which have implications for the number and type of children served, for the kinds of educational services provided, and for those delivering the interventions (Fuchs & Fuchs, 2006). Since the implementation of IDEIA 2004, research has increased regarding problem solving approaches such as RtI during the pre-referral process. RtI provides a means to demonstrate functional competence (VanDerHeyden & Witt, 2005) and a framework to guide intervention strategies within the context of the general education classroom. Mellard and Johnson (2008) considered RtI to be effective in addressing the needs of all students with the result of improving student performance.

Development of the Response to Intervention (RtI) Model

Fuchs, Fuchs, and Vaughn (2008) provided a working definition of RtI and the multi-tiered system of instruction in critical areas such as reading and mathematics. They noted:

> The context for preventing academic difficulty in the schools has changed over the past 5 years with the introduction of multi-tiered prevention systems. Adapted from the health care system, school-based multi-tier prevention systems typically involve three tiers. The first tier is research principled or validated classroom instruction. Students who are deemed at-risk for difficulty with the classroom program, usually on the basis of screening near the beginning of the school year, also receive a second tier of prevention, using a standard, validated small group

tutoring protocol, which can be expected to benefit most students. Only students who prove unresponsive to classroom instruction and to tutoring are referred for a comprehensive evaluation to consider the possibility of a disability that requires a third, more individualized tier of prevention, usually special education. (p. 28)

According to Fuchs and Fuchs (2006), the RtI model advocated a multi-tiered approach to intervention and applied it in math and reading, both as a mechanism for delivering quality-differentiated instruction and for identifying students who need interventions that are more intensive. In the RtI model, all students are exposed to a general curriculum that provides access to knowledge and skills necessary for success at the next grade level. Qualified teachers who use best practices to meet the needs of students by differentiated instruction deliver this curriculum. Highly qualified teachers are necessary at all tiers to ensure that students have adequate opportunities to obtain the skills needed to progress through their schooling experience.

Fuchs and Fuchs (2007) recommended using the three-tier model to help identify students' needs using universal screenings. The three-tier RtI model (see Figure 1) provides three levels of targeted, research-based interventions at varying intensity of difficulty to students who have been identified as at-risk for school failure.

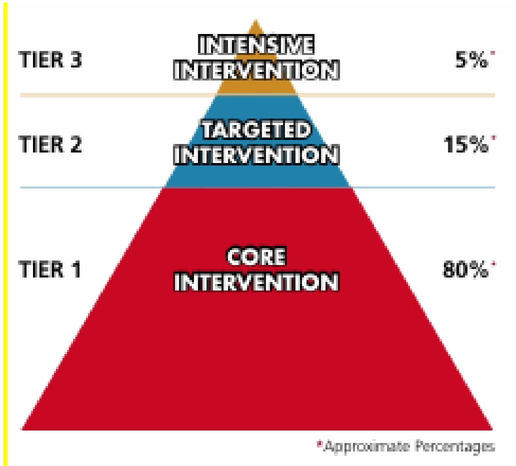

Figure 1. The three-tiered RtI model by United States Office of Special Education programs (2008).

A school's response to intervention problem solving team, consisting of a multi-disciplinary group of educators who create intensive, customized intervention plans for at-risk students who have not responded to lesser levels of academic/behavioral support, must be established (Ardoin, Witt, Connell, & Koenig, 2005). The team evaluates student data and determines which individuals need additional academic/behavioral interventions, what interventions should be used and how specific students move within the three-tiered system (Batsch, Curtis, Dorman, Castillo, & Porter, 2008). Schools that follow a structured problem solving process and develop a problem solving team enable at-risk learners to have more positive outcomes under RtI (Ardoin et al., 2005). When educators monitor student progress frequently to ensure interventions are successful or to determine whether more interventions are needed, student progress among the tiers of intervention is more likely (Batsch et al., 2008).

Within Tier I, all students receive high quality, scientifically based instruction within the general education classroom (Fuchs & Fuchs, 2007). Highly qualified teachers provide instruction to ensure that struggling students' difficulties are not due to inadequate teaching or deficiency in presentation of material. All students are screened on a periodic basis to establish an academic and behavioral baseline, to determine their levels of responsiveness, and to identify struggling learners who need additional support. Students identified as being at-risk through universal screenings and/or results on state or district tests receive supplemental instruction during the school day in the regular classroom. The length of time for this step can vary, but it generally should not exceed eight weeks. During this time, student progress is monitored closely by the problem solving team. At the end of this period, students who demonstrate significant progress remain in the regular classroom program. Students not demonstrating adequate progress are moved to Tier II to be provided additional supports beyond their regular classroom experience.

If the RtI team determines a plan is warranted, students are then exposed to targeted, group-based interventions that incorporate evidence-based practices, more frequent progress monitoring, and intensified instruction in addition to Tier I instruction (Fuchs & Fuchs, 2007). Tier II interventions are targeted and more intensive. The National Center for Learning Disabilities (2007) noted students not making adequate progress in the regular classroom are provided with increasingly intensive instruction matched to their needs based on levels of performance and rates of progress. They add intensity varies relative to group size, frequency, and duration of intervention as well as level of training of the professionals providing instruction or interventions. These services and interventions are provided in small group settings in addition to instruction in the general curriculum (Fuchs & Fuchs, 2006). A longer period of time may be required for Tier II interventions than for interventions received in the Tier I setting (National Center for Learning Disabilities, 2007). Students who continue to show too little progress within Tier II are then considered for more intensive Tier III interventions.

Students who are non-responders at the secondary intervention tier move to the tertiary intervention tier. At Tier III, teachers individualize interventions that target students' skill deficits. The interventions used comprise more frequent and intensive supports and may engender a referral to special education (Fuchs & Fuchs, 2007). Throughout this process, instructional interventions progress from very broad instruction the whole group receives to the individualized interventions specifically needed to addresses student academic shortcomings. The National Center for Learning Disabilities (2007) stated students who do not achieve the desired level of progress in response to these targeted interventions are then referred for a comprehensive evaluation and considered for eligibility for special education services under the IDEA of 2004. They suggested that data collected during Tiers I, II, and III are included and used to make eligibility decisions. At any point during the RtI process, IDEA 2004 permits parents to request a formal evaluation to determine eligibility for special education, and the RtI process cannot be used to deny or delay a formal evaluation for special education.

Components of the Response to Intervention (RtI) Model

No research exists indicating whether any one RtI tiered structure is better than another. However, an emerging consensus in the literature (Batsche et al., 2008; Chun & Witt, 2008; Fuchs & Fuchs, 2006; Johnson et al., 2006; Shinn, 2008; Vaughn, Gersten, & Chard, 2000) suggested a 3- or 4-tiered RtI model for delivering instruction best meets student needs. In the literature, RtI models are described differently, but the models that have been demonstrated as effective share common features. First, RtI models incorporate universal screening procedures and frequent progress monitoring. Then, the models employ data-based decision making and problem solving to determine if students require more or less intensive interventions and/or varied instruction (Fuchs & Fuchs, 2006). Second, RtI models provide a continuum of evidence-based services to all students, establish decision points to determine if students are performing at or below expectations, and develop a predetermined point at which students will be referred to special education if current interventions are not sufficient. Third, RtI models incorporate team-based structures and procedures to ensure implementation fidelity, including accurate and sustained implementation of the systems and practices in the model (Ardoin, 2006; Christ & Poncy, 2005; Fairbanks, Sugai, Guardino, & Lathrop, 2007; Fuchs &Fuchs, 2006; Gresham, 2004). As described in the literature (Fuchs & Fuchs, 2006; Johnson et al., 2006), a productive RtI model contains the following critical features:

- *High quality classroom instruction*: Students receive high quality, standards and research-based, culturally and linguistically relevant instruction in their classroom setting by highly qualified teachers.
- *High expectations*: Teachers believe every student can learn including students of poverty, students with disabilities, English learners, and students representing all ethnicities and subpopulations within the school.
- *Assessments and data collection*: An integrated data collection and assessment system includes universal screening, diagnostics, and progress monitoring to inform decisions appropriate for each tier.

- *Problem solving systems approach*: Collaborative teams use a problem solving process and method to identify problems, develop interventions, and evaluate the effectiveness of the intervention in a multi-tiered system of service delivery.
- *Research-based interventions*: If assessment data demonstrates a lack of progress, an appropriate research-based intervention is implemented. The interventions are designed to increase the intensity of the students' instructional experiences.
- *Fidelity of program implementation*: Student success in the RtI framework requires fidelity of implementation in the delivery of content and instructional strategies specific to the learning and/or behavioral needs of the student.
- *Staff development and collaboration*: All school staff members are trained in assessments, data analysis, programs, and research-based instructional practices and positive behavioral support. Problem solving teams use a collaborative approach to analyze student data and work together in the development, implementation, and monitoring of the intervention process.
- *Parent/family involvement*: The involvement and active participation of parents/families at all stages of the instructional and intervention processes are essential to improving the educational achievement of their students. Teachers keep parents/families informed of the progress of their students in their native language or other mode of communication, and their input is valued in making appropriate decisions.

- *Specific Learning Disability determination*: The RtI approach may be one component of specific learning disability determination as addressed in the IDEA of 2004 statute and regulations. As part of determining eligibility, the data from the RtI process may be used to ensure a student has received research-based instruction and interventions.

Although all of these characteristics need to be present for the effective implementation of an educational program, the development and work of the intervention team is crucial.

The Learning Disabilities of the World (2010) noted the key to an effective RtI program to form interventions and aid students with learning disabilities is building problem solving teams that use data to inform instruction. They stated the problem solving team’s focus is primarily to create strategies and interventions to help students be more successful academically. In addition, diverse representation and collegiality are essential elements of successful problem solving teams. Teams must be composed of a variety of educational staff including teachers, specialists, administrators, and parents. Team membership should include individuals who have a diverse set of skills and expertise that can address a variety of academic needs. High quality classroom teachers are central and valued members of the problem solving team. The Learning Disabilities of the World continued by asserting the team promotes a collegial atmosphere where members work together to solve student problems and use reliable and efficient assessment methods to measure the progress of struggling students. The USDOE (2008b) suggested a problem solving process includes a structured format when analyzing possible reasons for students’ academic needs and planning interventions. Using a structured problem solving approach when exploring, defining and prioritizing a teacher's or parent's concerns helps the team make efficient use of time and increases the probability the team will select the right interventions.

Effective RtI programs are designed to use data and research-based interventions to determine the success or lack of success in working to alleviate learning difficulties (Learning Disabilities of the World, 2010). These RtI programs benefit all learners including at-risk, gifted, and students with disabilities. Using benchmarks helps teachers monitor if student progress is being made and informs decisions to change instruction to maximize success, if necessary. This type of a system is effective in putting students into needed programs, removing them from unneeded programs, and monitoring them continually to make determinations of the need for support and/or services (USDOE, 2008a). Furthermore, it requires targeted interventions with research-based programs and strategies, further ensuring success for all learners (Learning Disabilities of the World, 2010). The USDOE (2008a) stated the most effective problem solving teams (a) define the problem, (b) directly measure the academic skill, (c) analyze the problem for the individual student, (d) validate the problem, (e) identify the variable(s) that contribute to the problem, (f) develop a plan for specific individualized intervention, (g) implement the plan, (h) monitor progress of the data, (i) modify interventions as necessary, (j) evaluate students' responses to the intervention(s), and (k) determine if more intervention is needed or if intervention(s) has been successful.

The Learning Disabilities of the World (2010) stated in an RtI model, teams can be used to make decisions at all tier levels. In addition, if these teams are properly designed with consistent procedures, they are integral in supporting the change process necessary for successful implementation of RtI. In Tier I intervention, a highly qualified classroom teacher implements differentiated instruction and interventions to ensure students learning needs are met. If students continue to demonstrate insufficient progress and the gap between the students' achievement and expected achievement increases, a more intensive intervention plan can be put in place with the assistance of the problem solving team through data driven dialogue (USDOE, 2008b). Evidence-based instructional strategies and strengths-based interventions in Tier II are developed based on the students' individualized and specific learning needs (Learning Disabilities of the World, 2010). Discussions about student progress in Tier II will occur formally in problem solving team meetings; however, informal discussions should be maintained on a weekly basis with the teacher and interventionist (USDOE, 2008b). The problem solving team determines if moving to a Tier III intervention is warranted after several individualized interventions have resulted in limited progress. This transition is based on the achievement gap between the students' progress and the expected benchmark. RtI problem solving teams are trained to use information from the data collected by schools and align the interventions with the strengths and needs of learners (Learning Disabilities of the World, 2010). It is only after repeated interventions are attempted and success is not evident that considerations for classification for purposes of receiving special education services become the next step. Using data effectively and efficiently ensures students get what they need before academic failure occurs (USDE, 2008a).

Data analysis and decision making occur at all levels of RtI implementation and all levels of instruction. American Institutes for Research (n.d.) surmised that teams use screening and progress monitoring data to make decisions about instruction, movement within the multi-level prevention system, and disability identification (See Figure 2).

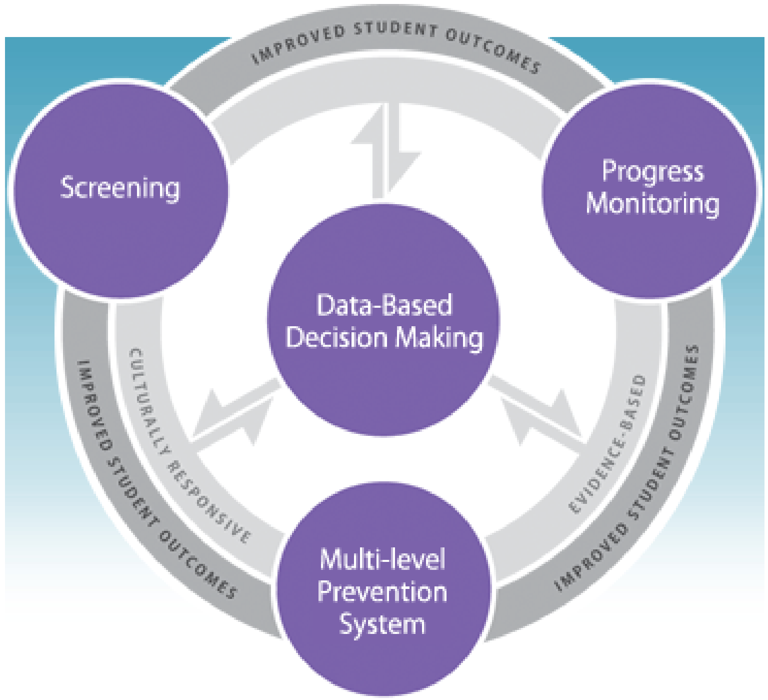

Figure 2. Data-based decision making model (American Institutes for Research, nd).

Progress monitoring is used to assess students' academic performance, to quantify a student rate of improvement or responsiveness to instruction, and to evaluate the effectiveness of instruction. They noted progress monitoring could be implemented with individual students or an entire class. In progress monitoring, attention should focus on fidelity of implementation and selection of evidence-based tools with consideration for cultural and linguistic responsiveness and recognition of student strengths. The collection, analysis, and use of academic data are central to the improvement of student outcomes envisioned by educators and administrators and needed to ensure students, schools, and school districts are meeting local, state, and federal policy mandates (National Dissemination Center for Children with Disabilities, 2010). In an education context, the National Dissemination Center for Children with Disabilities indicated that data based decision-making consists of educators and administrators systematically collecting and analyzing various types of data to guide a range of decisions to help improve the success of students and schools. A number of activities and decisions undertaken by schools and districts involve data-based decision making such as screening students for placement, using progress monitoring to determine curricular changes, and interpreting annual performance data to identify areas of weakness for future educational focus (American Institutes for Research, nod). Technology offers teachers a broad range of tools to collect and analyze data student data which guides instructional decisions (Sivan-Kachala & Bialo, 2000).

Types of Academic Interventions

For the most part, the body of research associated with academic interventions is connected to those identified as being learning disabled. The definition of learning disabled was changed in 1977 to include a single inclusionary criterion for each of the areas in which learning disabled could occur. The United States Office of Education (1977) noted the definition of learning disabled was " . . . a severe discrepancy between achievement and intellectual ability in one or more of the areas: (1) oral expression; (2) listening comprehension; (3) written expression; (4) basic reading skill; (5) reading comprehension; (6) mathematics calculation; or (7) mathematic reasoning" (p. G1082). The seven areas in which underachievement may occur were changed in IDEA (2004) to eight domains, essentially by adding reading fluency and changing mathematics reasoning to mathematics problem solving. To ensure underachievement in a child suspected of having a specific learning disability is not due to lack of appropriate instruction in reading or math, the group must consider two elements as part of the evaluation. The first element is data, which demonstrates that prior to or as a part of the referral process, the child was provided appropriate instruction in regular education settings that was delivered by qualified personnel. The second element is data-based documentation of repeated assessments of achievement at reasonable intervals reflecting formal assessment of student progress during instruction which was provided to the parents of the student.

Traditionally, schools have responded to educational disadvantages and learning disabilities with approaches such as ability grouping, grade retention, special education, and pull out programs in which students are removed from their regular classrooms and offered remedial instruction in core subject areas (Letgars, McDill, & McParland, 1994). Researchers now believe these approaches might actually reduce student engagement and learning opportunities while stigmatizing students (Slavin, 1988). The most promising approaches for these students are varied researched-based teaching strategies, high expectations from highly qualified teachers, and meaningful interventions (Benard, 1995). 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). Recent data has suggested that RtI approaches not only prevent academic failure but also improve academic outcomes for students (Ardoin et al., 2005). Buffman, Mattos, and Weber (2010) stated, “RtI's underlying premise is that schools should not wait until students fall far enough behind to qualify for special education to provide them with the help they need” (p. 14). They continued, “Instead, schools should provide targeted and systematic interventions to all students as soon as they demonstrate the need" (p. 14). Any population of learners with academic difficulties requires effective instructional approaches and interventions to prevent further difficulties and to augment and support their academic development (Wright, 2011). These interventions should be differentiated to meet the varying needs of all students (Buffum et al., 2009). When all students have guaranteed access to rigorous curriculum and effective initial teaching, targeted and timely supplemental support, and personalized intensive support from highly trained educators, few will experience failure (Sornson, Frost, & Burns, 2005). As the National Center for Learning Disabilities (2007) stated in the commission report on NCLB, "many argue that this population could be greatly diminished and better served by infusing (and eventually replacing) the current screening, assessment tools and procedures with the three tiered general education instruction model, Response to Intervention" (para.7). RtI includes the implementation of research-based strategies and instruction, monitoring of student progress, and modification of instruction based on student progress and need. Schools implementing RtI models frequently measure the extent to which students are responding to instruction and provide a continuum of interventions that become increasingly intensive and individualized as needed (Fuchs, Mock, Morgan, & Young, 2003).

The Need for Interventions in Reading

Researchers constantly strive to identify the most effective strategies for improving the comprehension levels of struggling readers. Comprehension is a necessary component to reading that involves the active gathering and building of meaning from text and serves as the ultimate goal of reading (Anderson, Hiebert, Scott, & Wilkinson, 1985; Rasinski, 2006). Research indicates repeated reading is necessary to provide opportunities for readers to become fluent and increase their comprehension (Al Otaiba & Fuchs, 2006; Corcoran & Davis, 2005; Rasinski, 2006). According to Rasinski (2006), guided oral repeated reading is supported as a means of increasing students' fluency and comprehension. Reading researchers found a direct correlation exists between oral reading fluency and the quality of students' reading comprehension (Kuhn et al., 2006; Pinnell, Pikulski, Wixson, Campbell, Gough, & Beatty, 1995).

According to the National Reading Panel Report (2006), successful reading development occurs when students have the capability of reading fluently with the ultimate goal of reading for meaning. Therefore, instruction in reading fluency and comprehension appears to be essential to the reading achievement of students. In order for teachers to accomplish the goal of increasing reading fluency and comprehension skills, teachers should directly or explicitly teach strategies to students involving accuracy and automaticity in word recognition and use a variety of context to develop fluency and expressive reading (Hudson, Lane, & Pullen, 2005). Success can be achieved when teachers provide guidance and feedback along with plenty of reading practice (Hudson et al., 2005; Kuhn, 2009). Although remedial efforts have typically focused on lower order reading skills such as word attack and word recognition, both researchers and teachers are increasingly exploring the efficacy of methods for improving these students' reading comprehension (Johnson, Graham, & Harris, 1997).

Numerous research studies have been conducted to determine the best practices for improving the reading comprehension levels of students identified as learning disabled. Much of the research focused on reading strategy instruction because many students who are learning disabled lack meta-cognitive skills. Students with a specific learning disability appear to be prime candidates for strategy instruction because their strategic reading behavior is often inefficient and inflexible (Johnson et al., 1997; Wong, Wong, Perry, & Sawatsky, 1986). When students with a specific learning disability are taught how to use meta-cognitive strategies and teachers facilitate the process, comprehension levels increase. Over the past 2 decades, many experiments have reaffirmed this theory. Students with a specific learning disability in reading comprehension have difficulty associating meaning with words (semantics), recognizing and recalling specific details, making inferences, drawing conclusions, and predicting outcomes, which are often attributed to a lack of meta-cognitive skills (Johnson et al., 1997).

Students learn better when new knowledge is connected to things they already know and understand (Hiebert & Carpenter, 1992). A synthesis of investigations into instructional techniques for students with learning disabilities showed scaffolding to be among the most effective approaches for teachers to use (Gersten, 1998). Scaffolding is one of the principles of effective instruction that enables teachers to accommodate individual student differentiated needs and build upon each student's existing knowledge (Kame'enui, Carnine, Dixon, Simmons, & Coyne, 2002). Three strategies for scaffolding content include organization of concepts, sequencing, and chunking or support teaching for conceptual understanding from a highly qualified teacher (Grouws & Cebulla, 2000). When students first learn a new concept or skill, the teacher carries most of the cognitive weight, providing extensive modeling, and articulating strategies and thought processes for all students. This type of support is essential for bridging the gap between what students actually know and can do on their own and the knowledge and skills they need to move to the next phase of learning (Rose, 2004). Routman (2003) found optimal learning is achieved when students move through phases of dependence to independence through the guidance of a highly qualified teacher using a gradual release of responsibility model of instruction. Thus, teachers should strive to develop independent learners.

The Need for Interventions in Mathematics

In a typical school, up to 20% of students will need additional interventions to address academic delays beyond what is available in the classroom (Wright, 2011). According to National Center for Education Statistics (2009b) AEP data, only 30% of middle school students are on grade level in reading and only 40% in math. These data correlate with research that emphasizes math problem solving and reading comprehension are two of the most needed content areas of interventions for students (Countinho & Oswald, 2004). Fuchs and Fuchs (1998) indicated prevention of mathematics difficulties in the United States is generally ineffective, not only for students with a specific learning disability associated with mathematics but for non-disabled learners as well. Gersten, Baker, and Lloyd (2000) reported one of the reasons for the lackluster mathematics performance includes the scarcity of well-designed intervention studies to validate effective teaching practices. Furthermore, National Assessment of Educational Progress (2003) found that although the trends for improvements in math have increased between the years 1990 to 2000, a large number of students still have substantial trouble solving math problems. In addition, many studies indicated that even though United States' students may not fare poorly when asked to perform straightforward computational problems, they often have difficulty understanding basic mathematical concepts in word problems and lack problem solving skills (National Research Council, 2001). In 2000, National Council of Teachers of Mathematics (2011) identified problem solving as its number one priority and still recognizes it as a main priority today. Fuchs et al. (2005) found that compared to the areas of reading and reading instruction, less is known about effective mathematics instruction and interventions that can aid children struggling in mathematics. As with students' reading disabilities, when math difficulties are present, they range from mild to severe. Evidence also suggests children manifest different types of disabilities in math. Unfortunately, research attempting to classify mathematical disabilities has yet to be validated or widely accepted; therefore, caution is required when considering descriptions of differing degrees of math disability. Still, students do experience not only differing intensities of math dilemmas but also different types that require diverse classroom instruction, interventions, and a highly qualified educator to determine what interventions are needed for each student, especially in the areas of mathematical problem solving (Wright, 2011). To help students become successful problem solvers, teachers must accept that students' problem solving abilities often develop slowly, thereby requiring long term, sustained attention to making problem solving an integral part of the mathematics program. Moreover, teachers must develop a regular and consistent culture of problem solving in their classroom. Students must also buy into the importance of regularly engaging in challenging activities (Lester, 1994).

Babbitt and Miller (1996) listed a variety of instructional strategies that have been used to teach problem solving skills. They indicated the most crucial components of these strategies as "reading the problems carefully, thinking about the problem via self-questioning or drawing, visualizing, underlying, or circling relevant information, determining the correct operation or solution strategy, writing the equation(s), and computing and checking the correct answer" (p. 392). Miller, Butler, and Lee (1998) synthesized the research on teaching mathematics problem solving to students with a specific learning disability and identified some effective problem solving interventions. These interventions included cognitive and meta-cognitive strategy instruction, the use of manipulatives and drawing, the use of schematic diagrams, and direct instruction involving fact families. According to Kinder and Stein (2006), many research reviews indicated student problem solving performance improved using instructional strategies of peer tutoring, directed instruction, and systematic feedback. In addition, research on effective instruction in the area of problem solving has focused on the utility of providing students with worked examples of word problems. A worked example involves the teacher modeling the problem solving process prior to students engaging in the problem solving process independently. Research by Cooper and Sweller (1987) examined the role of worked examples in problem solving instructional strategies and suggested worked examples help students break the process into clear sub-goals to aid them in discovering the relationship to the problem situation as well as to the solution strategy. Furthermore, Cooper and Sweller found providing students with worked examples increased their instructional efficiency in addition to improving their transfer of knowledge for learning.

Butler, Miller, Crehan, Babbitt, and Pierce (2003) conducted a study to evaluate the effectiveness of two problem solving instructional methods. These methods include (a) the concrete-representational-abstract (C-R-A) instructional sequence and (b) the representational-abstract (R-A) instructional sequence for fraction related instruction. Specifically, the purpose of the study compared the effects of the two instructional sequences as differentiated learning for students. The participants in the study were 50 middle school students identified with mild to moderate disabilities in mathematics. Paired sample *t*-tests were used to measure performance differences between the participants who received C-R-A instruction and those who received R-A instruction. The results of the *t*-tests indicated a significant improvement in all areas of the five subtests (i.e., Area Fractions, Quantity Fractions, Improper Fractions, Abstract Fractions, Word Problems) for both groups, except the Area Fraction Subtest for the C-R-A group. Results from a multivariate analysis of covariance test showed that although the C-R-A had statistically significant results on the Quality Fractions subtests, test results were similar for both the C-R-A and R-A instructional strategies within the other four subtests.

Teacher Facilitated Instruction in Combination with Technology

Computer-assisted instruction (CAI) has emerged as an intervention delivery and progress monitoring system for struggling learners. This is due to the widespread availability of technology and the advent of RtI processes, coupled with IDEIA allowing general education access to funds previously reserved for those receiving special education services. Findings from the International Association for K-12 Online Learning (INACOL, 2010) report, *An Exploration of At- Risk Learners and Online Education*, suggested CAI supports increased motivation, student engagement, and achievement success for at-risk students due in large part to the flexibility and self-paced nature of online delivery programs. The National Council of Teachers of Mathematics (2000) recommended using technological tools and noted they allow students to focus on “decision making, reflection, reasoning, and problem solving” (p. 24). The role of teachers is to revise, select, and develop tasks that are likely to foster the development of understanding and mastery of procedures in a way that also promotes the development of abilities to solve problems and reason and communicate mathematically (National Council of Teachers of Mathematics, 1991).

The USDOE (2009) found instruction combining CAI and face-to-face teacher facilitated instruction had a larger advantage relative to purely face-to-face instruction or purely CAI. Goldman, Pellegrino, and Mertz (1999) found extended practice with computers increased automaticity in basic math tasks for children identified learning disabled. Roblyer (2004) advocated technology could help students achieve higher levels of understanding by giving them real life experience relevant to their individual needs.

Another benefit to CAI involves the potential for individualizing certain aspects of instruction to the needs of individual students. For example, CAI interventions often adjust the pacing of instruction and difficulty level to the performance of the student. In addition, CAI programs provide the student with extensive opportunities to respond as well as providing timely and specific feedback on the accuracy of those responses. CAI programs can also be designed to provide the teacher with assessment data that charts students’ growth on particular skills. These aspects of instruction have been demonstrated to be particularly effective at improving student outcomes across the curriculum (Trifiletti, Frith, & Armstrong 1984).

Researchers have begun to look at the effects of the use of computers on more traditional teacher facilitated instruction. According to Babbitt and Miller (1996), the results of these studies have been mixed. Trifiletti et al., (1984) compared the effects of

SPARK-80 Computerized Mathematics System to traditional resource room instruction using Steck-Vaughn math workbooks. They found the computerized program was more effective than the traditional resource room instruction. However, Berthhold and Sachs (1974) found the use of computers with students identified learning disabled produced the opposite effect when compared to traditional instruction. Bahr and Rieth (1989) showed the combination of directed highly qualified teacher intervention and CAI was more effective than CAI alone.

Scholastic Read 180, a CAI Intervention in Reading

The Scholastic READ 180 program combines large group, small group, and individualized CAI. Scholastic READ 180 (n.d.) stated that READ 180 is an intervention program for upper-elementary, middle, and high school students who are struggling with reading. Ted Hasselbring and Laura Goin originally developed the program in 2004 at Vanderbilt University (Scholastic READ 180, 2006). Each 90-minute period of instruction begins with a 20-minute shared reading and skills lesson. Students then rotate among CAI reading, modeled or independent reading, and small group instruction with a highly qualified teacher. The software includes videos mostly about science and social studies topics. Students read about the video content and engage in comprehension, vocabulary, fluency, and word study activities around this content. In addition, audio books model comprehension, vocabulary, and self-monitoring strategies used by advanced readers, and students read levelized books in many genres. Teachers are given materials and attend workshops to support instruction in reading strategies, comprehension, word study, and vocabulary. A key methodological problem in studies of READ 180 is that many students in READ 180 classes received considerably more instructional time in reading than did their counterparts in control classes (Krotofil, 2006).

Woods (2007) evaluated READ 180 in an urban school located in southeastern Virginia with two cohorts of reading intervention students. Cohort 1 and Cohort 2 were enrolled in middle school during the 2003–2004 and the 2004–2005 academic years, respectively. Data from a third cohort could not be used because the Scholastic Reading Inventory measured the outcome, which was a different measure than the previous cohorts. Students in grades 6, 7, and 8 who needed additional literacy support (n = 268) were assigned to either READ 180 or the traditional reading remediation program based on reading pretests and teacher recommendations. READ 180 and comparison students were matched on reading pretests and demographic factors. Approximately 57% of students participating in the study received free lunch, 63% were African-American, and 32% were white. There were 58 student participants in the READ 180 program during the 2003–2004 school year and 76 participants during the 2004–2005 school year. An equal number of control students participated in the traditional reading remediation program. Students in the treatment group received 90 minutes of READ 180 every other day for the entire school year, whereas students in the comparison condition received 90 minutes of the traditional reading remediation program every other day for one quarter of the school year. At the end of the 2003–2004 school year, Cohort 1 students who experienced READ 180 gained slightly more on the Degrees of Reading Power test than the control group (ES = 0.05). The use of this test was discontinued, and comparisons between students who participated in READ 180 during the 2004–2005 school year and those who experienced the traditional reading remediation program were conducted using the STAR Reading assessment program. READ 180 students in Cohort 2 made substantially greater gains on STAR Reading (*ES* = 0.81). The effect size combined across the two cohorts was 0.43.

Caggiano (2007) conducted a yearlong study of 120 mostly African-American struggling readers enrolled in grades 6, 7, and 8 in an urban middle school located in southeastern Virginia. Participants included 20 students from each grade in the READ 180 program. These 60 students were matched with 60 nonparticipants by grade level, gender, ethnicity, and the Scholastic Reading Inventory pretest. All classes received 75 minutes of language arts instruction each day. The students in the experimental group received an additional 90 minutes of supplementary instruction every other day using READ 180. Students were post tested using both the Scholastic Reading Inventory and the Virginia Standards of Learning test. The Scholastic Reading Inventory was included as an assessment tool in the READ 180 package, and therefore, only the Virginia Standards of Learning test using Scholastic Reading Inventory pretests as covariates were reported. On adjusted posttests, effect sizes were 0.64 at grade 6, –0.29 at grade 7, and –0.31 at grade 8, for an overall mean effect size of 0.01.

Nave (2007) conducted a small retrospective analysis of READ 180 with 110 seventh graders in Sevier County, Tennessee. The Tennessee Comprehensive Assessment Program was used to compare the performance of academically at-risk students who participated in the READ 180 program (n = 80) during the 2004–2005 school year to that of a similar group of at-risk students (n = 30) who did not participate in the program. There were substantial positive effects on Tennessee Comprehensive Assessment

Program Reading–Language Arts scores (*ES* = 1.58). These scores indicated that READ 180 enabled at-risk students to achieve higher in reading and language arts subtests.

PLATO, a CAI Intervention in Math and Reading

Dear (2010) noted PLATO Learning traces its roots back to the University of Illinois. In the early 1960s, at the university's Urbana campus, electrical engineering professor Don Bitzer and physics professor Chalmers Sherwin were intrigued by the idea of using computers for teaching. Operating on grant money from the National Science Foundation, the two men designed and developed the nation's first computer-based education system, which they called PLATO and is an acronym for Programmed Logic for Automatic Teaching Operations. The original system could only support a single classroom of users, but in the early 1970s, PLATO was migrated to a larger scale mainframe environment, which allowed for hundreds of simultaneous users (PLATO, n.d.b). In 1976, Control Data obtained the rights to the PLATO system with plans to sell it to K-12 schools, but sales failed to materialize because most public and private schools lacked the resources and finances necessary to purchase and implement the program. In September of 1989, Control Data sold the PLATO system to William R. Roach (Dear, 2010). PLATO's new owner had previously been president of Applied Learning International, a subsidiary of National Education Corp and strongly believed in computer-based K-12 education. Because many potential customers believed the system was outmoded and outstripped by applications that are more modern, Roach lost $12 million dollars the first year because of his decision to invest heavily in the K-12 segment of the business. Roach’s desire was to move PLATO away from adult literacy and back toward programs that could be integrated into standard school curriculum. In 1990, the system was installed in only 50 schools and changed its name to TRO Learning, Inc. Between 1992 and 1995, TRO continued major changes including a range of instructional improvements, a new user interface with graphics based function buttons, and new graphics and animation designed to both appeal to the target audience and contribute to learning objectives (PLATO, n.d.b). In 1998, TRO sold its business section to the United Kingdom-based VEGA group, leaving the company with a single focus, the PLATO education system (Dear, 2010).

By the end of 1998 fiscal year, demand for the PLATO system had increased with sales of courseware and related services climbing nearly 30% (PLATO, n.d.b). In late 1999, the company collaborated with Sylvan Learning Centers to provide PLATO courses throughout the more than 750 Sylvan learning centers. Other sales initiatives focused on a newly introduced product: single topic PLATO courses. The single topic courses broadened the company's pool of potential customers considerably and included individual users who needed reinforcement only in certain academic areas. Dear (2010) also observed small, rural school markets were attracted to this concept because many lacked the financing or capability to implement the entire curricula.

TRO started 2000 with two major announcements; the first involved a change in identity and the second a change in leadership (PLATO, n.d.b). In 2000, the company announced it would be changing its name to PLATO Learning to promote recognition of its long held brand name. John Murray was later appointed CEO, and by the end of 2000, PLATO was installed in approximately 5,000 schools. In 2006, the PLATO Learning Environment debuted. This online learning platform provided integrated data, assessment, reporting, curriculum, and course management features to support school and district online learning programs. In 2007, PLATO Learning developers expanded online platform features and rigorous online course offerings in mathematics, science, social studies and English/language arts, including Advanced Placement courses. In addition, PLATO Learning continues to develop online learning technologies including student/teacher communications, reporting and data features, and course management options that provide more personalized learning options and effective support of online course delivery. In 2010, the company introduced PLATO Learning Environment 2.0, which featured greater flexibility, an improved user interface, and more robust reporting and collaboration tools for implementing interventions in K-12 schools.

Use of PLATO as a Tier II Intervention

PLATO (n.d.a) courses are delivered online primarily in one of three ways. The first model is called the Pure Virtual Model. In this environment, face-to-face interaction between students and teachers is limited. Teachers assign courses to students using PLATO communications and report features to provide instruction, monitor student progress, and communicate directly with students. The second model is called the Blended Model. In this type of implementation, the course is designed to blend classroom-based instruction with online instruction. Teachers typically deliver course components via a whole class, small group, or individual direct instruction model, with some components assigned using PLATO online learning solutions. PLATO assignments may include entire courses or specific course components such as units, assessments, and/or offline activities. The third model is known as the Intervention Model. Students sometimes use PLATO courses to accelerate learning or engage in remediation. Intervention programs are typically based on specific student learning need and incorporate full courses, strategies, lessons, modules, etc. Teachers often work one-on-one with students or in small groups to provide targeted instruction. This intervention module describes how PLATO can be used as a Tier II intervention for the school district being examined (Ogonosky, 2011).

In Tier II, students typically receive explicit instruction three to 5 times a week ranging from 20 to 40 minutes of intensive targeted instruction. PLATO Learning provides self-paced, personalized instruction to accommodate the three tier RtI model, especially within a Tier II level of intervention (PLATO, n.d.a). PLATO Learning offers differentiated standards aligned curriculum and instruction along with diagnostic assessments that are developmentally and age appropriate within an interactive online instruction. PLATO Learning also claims to account for each learner's individual needs and learning styles to provide explicit instruction based upon areas of academic need.

In fall 2009, Lakeville South High School's RtI problem solving team used PLATO Online Learning solutions to implement a Tier II intervention program for 9th and 10th grade students who were struggling with math (Amoroso, Douglas, Cronin, & Molesky, 2010). Educators provided additional targeted support through a period of personalized mathematics instruction on an alternating day cycle each week. Overall, 102 students in 9th and 10th grade participated in Lakeville South's math intervention program during the 2009–2010 academic year, and 25 students who were eligible for the program elected not to participate. The average growth for students in the PLATO intervention program between the fall and winter administrations on the PLATO national assessments was 5.12 points compared to 2.6 for students who did not participate in the program. Amoroso et al. reported a significant difference between the groups, meaning the intervention produced a statistically significant increase in learning for students in the program compared to students who did not participate.

Although the previous study used PLATO as a Tier II intervention in mathematics for upper grades, Tier II interventions, as part of the RtI process, are also needed for middle school students in both mathematical problem solving and reading comprehension (Caggiano, 2007). CAI has the potential to reach a large number of students with individualized lessons (Roblyer, 2004). In addition, highly effective teachers are important to ensure all students' academic needs are met (Rose, 2004). The combination of CAI and highly effective teachers has been shown to provide the most effective intervention for students in academic need (Trifiletti et al., 1984).

Conclusion

Since NCLB and the revision of IDEA to IDEIA 2004, there has been a call to enhance instructional interventions to improve student performance. Emphasis has been placed on diagnosis of individual student strengths and weaknesses, on targeting intervention based on need, on delivery of interventions with fidelity, and on monitoring of student progress. Numerous programs have been initiated and billions of dollars have been spent to ensure all students achieve. However, the criterion has changed in the process of identifying students who need interventions. Brown-Chidsey and Steege (2005) noted IDEIA removed the requirement of the significant discrepancy formula in identifying learning disabilities from intelligence quotient tests. This opened the door for states to adopt other approaches for intervention.

The RtI model was implemented to aid in the identification of specific learning disabilities. Brown-Chidsey and Steege (2005) purported students cannot be identified as students with specific learning disabilities if they have not received scientifically-based instruction under IDEIA 2004. The RtI model is used to comply with this legislation. Schools need to show documentation that from the beginning, students have had access to and participated in effective Tier I with a highly qualified teacher. At that point, if students are still experiencing academic difficulties, a team determines appropriate interventions in a Tier II instructional environment. All this must take place before students are considered for Tier III or special education.

In reference to any discussion on RtI and its relevance to IDEIA, NCLB and specific learning disability identification are included in Part 6(B) of IDEIA. The law combines or infuses the language of Part 5 on scientifically-based instruction with RtI procedures. It 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” (Brown-Chidsey & Steege, 2005, p. 24). Brown-Chidsey and Steege (2005) also noted it is important that this part does not stand alone. In combination with the other components of the IDEIA reauthorization and NCLB, it serves as direction and a “…bridge between general and special education by referencing NCLB requirements in the law” (p. 24). Within the three tier model of RtI, Tier II is an important tier to enable those students who do not understand the general curriculum to get academic interventions which address their individual academic needs.

Access to technology has grown rapidly in American schools during the last decade. Today, nearly all schools own computers and have access to internet resources. The use of educational technology in K-12 classrooms has been gaining tremendous momentum across the country since the 1990s. Computers are an important resource for student learning.

CAI is an effective intervention for students in the areas of reading and mathematics. CAI has been studied for its effects on lower achieving students (Barley et al., 2002). Barley et al. (2002) argued the effectiveness has been attributed to it being non-judgmental and motivational while giving immediate and frequent feedback, individualizing learning to meet the students' needs, allowing for more student autonomy, and providing multi-sensory components. A review of 17 different studies by Barley et al. found that CAI positively affected scores in mathematics and literacy for all grade levels and significantly improved scores for students labeled at-risk). CAI combined with a highly qualified teacher can make a significant impact on student academic achievement (Johnson, 2000). Good teachers can positively shape students' lives long after they leave the classroom (Chetty, Friedman, & Rockoff, 2011).

This study investigated the use of PLATO, a data driven model for ensuring student achievement as a CAI Tier II intervention. This study began to determine the effects of PLATO alone or the effects of PLATO combined with a highly qualified teacher's small group instruction as a Tier 2 intervention on math and reading achievement for students in the fifth and sixth grade. The study also determined if PLATO could effectively be an academic intervention to monitor students' progress on individual adequate yearly progress to pass grade level standards.

CHAPTER III

METHODOLOGY

As reported by the National Joint Committee on Learning Disabilities (2005), the focus of RtI is on the accountability of the teaching and learning processes in general education. A key component of RtI is early intervention at the first sign of academic difficulties with the purpose of improving academic achievement for all students, including any at-risk students who may have a specific learning disability. Strong evidence existed concerning the effectiveness of many of the targeted interventions used within RtI to improve reading and math skills for all students (Burns, Appleton, & Stehouwer, 2005; Coleman, Buysse, & Neitzel, 2006; Gertsen et al., 2009). Findings from this research offered an emerging body of empirical evidence to support RtI as an effective method for identifying at-risk students and improving academic progress through the provisions of specialized research-based interventions. Through data-based decision making, the provision of tiers of interventions ensures academic progress is being made and decreases referrals to special education by providing needed differentiated interventions (Williams, 2006). Some schools have used computer-assisted instruction (CAI) as a Tier II researched-based intervention, which has been shown to improve students' academic achievement (Moody, nod).

The purpose of this study was three dimensional in its intent. The first dimension of the study was to determine if interaction differences by gender existed between students who were exposed to PLATO combined with small group instruction and students who were exposed to PLATO only. In the school district under study, PLATO was used as a CAI Tier II intervention to monitor student progress relative to grade level expectations. The second dimension of the study was to determine if differences existed between male and female students regardless of exposure to an instructional method. The third dimension of the study was to determine if differences existed between the two instructional methods regardless of gender. Both fifth and sixth grade students were examined.

The researcher generated the following null hypotheses to guide the study, and data were collected to monitor individual academic progress made.

1. After controlling for math achievement on the 2010 ACTAAP Augmented Benchmark Exam, no significant difference will exist by gender between fifth grade students in two intermediate schools within a suburban school district in Central Arkansas who were exposed to a combination of an online computer-assisted instructional program (PLATO) and small group instruction versus those who were exposed to the online program only on math achievement measured by the ACTAAP Augmented Benchmark Exam.
2. After controlling for math achievement on the 2010 ACTAAP Augmented Benchmark Exam, no significant difference will exist by gender between sixth grade students in two intermediate schools within a suburban school district in Central Arkansas who were exposed to a combination of an online computer-assisted instructional program (PLATO) and small group instruction versus

those who were exposed to the online program only on math achievement measured by the ACTAAP Augmented Benchmark Exam.

3. After controlling for reading achievement on the 2010 ACTAAP Augmented Benchmark Exam, no significant difference will exist by gender between fifth grade students in two intermediate schools within a suburban school district in Central Arkansas who were exposed to a combination of an online computer-assisted instructional program (PLATO) and small group instruction versus those who were exposed to the online program only on reading achievement measured by the ACTAAP Augmented Benchmark Exam.
4. After controlling for reading achievement on the 2010 ACTAAP Augmented Benchmark Exam, no significant difference will exist by gender between sixth grade students in two intermediate schools within a suburban school district in Central Arkansas who were exposed to a combination of an online computer-assisted instructional program (PLATO) and small group instruction versus those who were exposed to the online program on reading achievement measured by the ACTAAP Augmented Benchmark Exam.

This chapter will discuss the research design, the process of obtaining a sample, and a description of the sample population. The instrument used to measure student achievement will also be discussed, and the data collection and statistical analysis processes are outlined. Finally, the limitations of the study are summarized.

Research Design

This study was designed as a quantitative, causal comparative study, which was conducted at two intermediate schools (grades 5 and 6) in a suburban school district in

Central Arkansas. According to Johnson and Christensen (2008), causal comparative research methods are appropriate for studies that focus on the collection of quantitative data with no manipulation of the independent variable and no random assignment to groups by the researcher. According to Gay, Mills, and Airasian (2009), a causal comparative study was suitable in this situation because the instructional methods were already in place when the researcher began the study. Thus, they were not manipulated. The main independent variable, instructional teaching strategy (PLATO in combination with small group instruction versus PLATO only), was already occurring in the school, and the researcher chose to study its effects after the fact.

Sample

This study examined the effects of PLATO as a CAI on reading and math achievement for students in the fifth and sixth grades in a suburban Central Arkansas school district. The fifth and sixth grades within the two schools of the district had a total population of 1,357 students. The students ranged in age from 10 to 12 years of age. The two schools were chosen based on their similar student demographics of grade configuration and ethnicity. Each of the two intermediate schools had an approximate population of 700 students. Classes consisted of approximately 24 students each. Of the participants in both schools, approximately 56% were male and 44% were female. Approximately 61% of students were Caucasian, 25% were African-American, 10% were Hispanic, 3% were Asian, and 1% was Native American. Although the two schools differed regarding socioeconomic status (School 1 with 35% free or reduced price lunches and School 2 with 64%), the two subgroups involved in this study were similar with regard to socioeconomic status (School 1 with 33% and School 2 with 37%).

This study was focused on the sample of the population considered at-risk in the areas of math and reading. The Arkansas Department of Education (2010) uses four proficiency levels on the ACTAAP Augmented Benchmark Exam to categorize students' scores. The four proficiency levels include below basic, basic, proficient, and advanced. The two schools identified at-risk students at the beginning of the school year to be those students scoring basic or below basic on the Augmented ACSIP Exam or scoring proficient by less than 10 points. Classroom and district assessments were used throughout the year to determine if additional students were in need of Tier II interventions. The PLATO intervention was used in 14 intact classrooms in the two intermediate schools; these cluster groups made up the participants in the study with seven classrooms at each school. Students in these classrooms also met the requirements for at-risk defined by the school district. Students within the classrooms were then selected by stratified random sampling to ensure that the subpopulations of race and gender were represented. According to Gay et al. (2009), stratified random sampling is a fitting method to guarantee desired representation of relevant subgroups within a sample. For these students, the school used PLATO as an intervention and had a highly qualified teacher as an intervention specialist for their Tier II instruction.

The researcher received a Microsoft Excel 2011 spreadsheet sent by the district containing fifth and sixth grade students' scaled scores in both math and reading for the 2009-2010 and 2010-2011 school years. The district obtained this student achievement data from the National Office for Research on Measurement and Evaluation System (NORMES). The researcher eliminated all students scoring proficient and advanced except for those students who scored proficient by 10 points or less. Students who did not complete both the reading and math portions of the ACTAAP Augmented Benchmark Exam during both the 2009-2010 and 2010- 2011 school years were also eliminated from the study. Students not completing the testing included a few special education students and a few Limited English Proficient (LEP) students who were exempt from testing. To ensure students were enrolled in the respective classes for the majority of the school year, those students enrolled after October 1, 2010 were also eliminated. Because October 1 is the date used by the Arkansas Department of Education (2010) in determining whether a district is accountable for student achievement scores under NCLB, students enrolled after October 1 were considered highly mobile students. Therefore, their scores did not count for or against the school when calculating adequate yearly progress. After eliminating non-qualified students, the researcher isolated the four strata for each grade level (PLATO with small group and male, PLATO with small group and female, PLATO only and male, PLATO only and female). The researcher randomly chose 50 students for each cell to keep all groups equivalent. Selecting equal numbers of students from each of the four groups was important for the statistical analysis (Johnson & Christensen, 2008).

Four teachers were involved in the study; one was a National Board Certified teacher who was also certified in special education, and one was taking graduate level classes on achieving National Board Certification. Three of the four teachers had their master’s degrees, and all four teachers were highly qualified teachers in the areas of math and reading for fifth and sixth grade. All had approximately 20 years of teaching experience. The researcher did teach at one of the schools within the study, but neither the researcher nor any of the researcher’s students were participants within the study.

Instrumentation

The Arkansas Comprehensive Testing, Accountability, and Assessment Program (ACTAAP) is the foundation for all testing and accountability in the state of Arkansas. Specifically, the Arkansas ACTAAP Augmented Benchmark Examination was used to measure the reading and math achievement in addressing each hypothesis. Two components comprise the tests for grades 3–8: a criterion-referenced test and a norm-referenced test. The criterion-referenced test component is focused on establishing student performance levels and contains items specifically aligned with grade level Arkansas state education standards. The reading and math performance levels, determined by the 2010 ACTAAP Augmented Benchmark Exam, were used to identify students who were proficient or above, which is considered to be at grade level. Permission to use the data was granted by the district superintendent of the schools in the study.

As noted in the Joint Committee on Standards for Educational and Psychological Testing of the AERA, APA, and NCME (1999), validity is the most important consideration in test evaluation. Messick (1989) defined validity as "an integrated evaluative judgment of the degree to which empirical evidence and theoretical rationales support the adequacy and appropriateness of inferences and actions based on test scores or other modes of assessment." (p. 5). This definition implies that test validation is the process of accumulating evidence to support intended use of test scores. Consequently, test validation is a series of ongoing and independent processes that are essentially independent investigations of the appropriate use of interpretation of test scores from a particular measurement procedure (Suen, 1990). In addition, test validation embraces all of the experimental, statistical, and philosophical means by which hypotheses and scientific theories can be evaluated. Members of the Arkansas Department of Education (2010) determined the ACTAAP Augmented Benchmark Exam to be both reliable and valid. Researchers at the Arkansas Department of Education (2001) reported that the ACTAAP Augmented Benchmark Exam has "technically sound levels of reliability, validity, and fairness, based on the extensive research that underlies both the CRT and NRT item sets" (p. 6).

To investigate the validity evidence of the Arkansas Augmented Benchmark Examination, content related evidence, evidence of internal structure, and evidence of fairness were collected. Content validity is the extent to which the items in a test adequately represent the domain of items or the construct of interest (Suen, 1990). Consequently, content validity provides judgmental evidence in support of the domain relevance and representativeness of the content in the test (Messick, 1989). The Arkansas Augmented Benchmark Examination aligned the content in the math and reading assessment with the grade level Arkansas State Content Educational Standards.

An assessment procedure is not a random collection of assessment tasks or questions. Each question or task within the assessment should contribute positively to the total result. The relationship among the tasks on an assessment can be defined as the internal structure of the assessment (Pearson, 2010). Correlations were obtained to ensure the internal structure of the assessment remain among the reporting strands for each subtest. The correlations among the reporting strands range from .50 to .99.

Evidence of fairness was collected by providing information about Differential Item Functioning analysis. Differential Item Functioning analysis was carried out for gender and ethnicity. For the gender analyses, the reference group was male students and the focal group was female students. With respect to ethnicity, the *n*-count was only sufficient to carry out Differential Item Functioning analyses for Caucasian versus African-American students. For the ethnicity analyses, the reference group was Caucasian students and the focal group was African-American students.

The ACTAAP Augmented Benchmark Exam is developed around a common design from year to year (Pearson, 2010; Questar, 2011). Although the test forms are commonly designed, post-equating is used to control varying levels of difficulty from one version of the test to the next. The Technical Advisory Committee noted that these equating methods are empirical procedures for establishing uniformity between raw scores on different test forms. Linking items are used to connect one test version to another test version of the ACTAAP Augmented Benchmark Exam (Pearson, 2010). Evaluators use the connection items to place test items on the same scale as the previous year with a common item, non-equivalent groups linking strategy. From this linking strategy, parameters are established to ensure consistency between different forms of the test. Accuracy rates were .89 or above for all grades in both reading and mathematics.

According to the technical report, the approach approved by the Technical Advisory Committee is the Stratified Alpha method. In this approach, “reliability for each item type was estimated separately for reliability and then combined with other item types’ reliabilities to yield a more accurate estimate of the overall reliability” (Pearson, 2010, p. 59). The outcomes of these assessments are used to determine adequate yearly progress as mandated in the NCLB. Students in grades 3-8 are given approximately 2.5 hours daily to complete the 4-day test. The test items in both reading and math include multiple choice and open response questions. The four levels of student achievement on these criterion-referenced exams include advanced, proficient, basic, and below basic. Each performance category has a range of specific scale scores by grade level in both mathematics and reading that corresponds to a particular performance level. Pearson sets these scale scores to demonstrate academic growth when comparing scale scores from one year to the next.

Data Collection Procedures

Permission was obtained from the superintendent of the school system used in the study. Two schools within this school district were chosen to collect student data. The superintendent was sent an email with a letter attached explaining the study and requesting permission for use of the data. An electronic reply to the request was used as documentation of permission granted. After approval by the Institutional Review Board (see Appendix A), student scale scores for literacy and math for spring 2010 and 2011 administration of the Augmented Arkansas Benchmark Exams were collected for analysis. The district was given a unique user name and password to access the scores of their students on the NORMES website. The district exported student data by grade level in Microsoft Excel 2007 spreadsheets and sent the data electronically. All data were coded to maintain confidentiality; therefore, identities of the individual students were concealed and the information was kept confidential.

Plato was first introduced to the school districts at the secondary level as secondary CAI school credit recovery intervention in the spring of the 2005-2006 school year. PLATO then was incorporated as a CAI Tier II intervention for at-risk students in grades 5, 6, 7, and 8 in the 2006-2007 school year. Because the schools within the study only contained grades 5 and 6, they were the only grades used within the study. The covariates of the study were the 2010 students' scale scores from the ACTAAP Augmented Benchmark Exam in both reading and mathematics. The covariates were used to designate if growth was made after receiving the independent variables of PLATO instruction or PLATO instruction combined with small group instruction from a highly qualified teacher.

Analytical Methods

Before running statistical tests, data were examined and checked to ensure accuracy and to verify that the assumptions were met for the tests of significance (Sirkin, 2006). Statistics Package for the Social Sciences (SPSS 18.0) was used for analyzing the data. Factorial Analyses of Covariances (ANCOVAs) were used to assess the differences in math and reading scores between the four groups at each grade level (PLATO with small group and male, PLATO with small group and female, PLATO only and male, PLATO only and female). Factorial ANCOVAs were used because it allowed the researcher to equalize the initial differences in groups based upon the previous year's ACTAAP Augmented Benchmark Exam scaled scores (Salkind, 2008). The dependent variables were math and reading achievement measured by the scores on the 2010-2011 ACTAAP Augmented Benchmark Exam, and the covariates were the previous year's scores.

Limitations

Non-experimental research projects usually involve limitations that are out of the control of the researcher (Johnson & Christensen, 2008). It is important for the reader to determine what effects these limitations have on the interpretation of the results of the study. The first limitation of the study was the inability of the researcher to hold all other variables constant that have an effect on student achievement. The ability to pinpoint exactly what new programs, changing instructional strategies, professional development taken by teachers, and changes in personnel may have had on student achievement was outside the control of the researcher.

The second limitation of the study was the scale score cutoff considered for at-risk students (Arkansas Department of Education, 2011). Arkansas has a specific scale score of 604 for fifth graders to be considered proficient and a scale score of 641 for a sixth grader to be considered proficient; the schools within the study included those students who achieved proficiency but had lower scale scores of proficiency (less than 10 points). The schools within the study used a scale score of 610 for fifth graders and 650 for sixth graders to include within their Tier II interventions, which included the use of PLATO. The schools also used PLATO for all special education students whether they achieved proficiency of the Augmented ASCIP Benchmark Exam or not.

A third limitation was the experience of the teachers. The teachers within this study all had around 20 years of experience and were all highly qualified in the areas of math and reading. One of the teachers was a Nationally Board Certified teacher and was certified as a special education teacher in addition to the certification of elementary teacher. Other schools may have teachers who work with at-risk students who do not have this amount of experience or education. This experience may lead to more knowledge of instructional strategies, data analysis, or knowledge of students learning.

A fourth limitation was the tiers of intervention used by the schools within this study. The schools in the study used a three-tier model of RtI; other schools may use a different number of tiers of interventions within their RtI model. The fact that this study was limited to only two schools may limit generalizing the results to schools in other parts of the state of Arkansas.

CHAPTER IV

RESULTS

The researcher used quantitative data collected from two schools within a suburban school district in Central Arkansas to examine the effects of computer-assisted interventions (PLATO only or a combination of PLATO with small group instruction from a highly qualified teacher) on math and reading achievement. The researcher focused on the sample of the population considered at-risk in the areas of math and reading and assigned students to the interventions. The two schools identified at-risk students at the beginning of the school year to be those students scoring basic or below basic on the Augmented ACSIP Exam or scoring proficient by less than 10 points. This study examined the effect of the two instructional strategies on student math and reading achievement on the 2011 Arkansas Augmented Benchmark Exam. The independent variables were gender (male versus female), grade (fifth versus sixth), and instructional strategy (PLATO only versus PLATO with small group instruction from a highly qualified teacher). The dependent variables were math and reading achievement measured by scale scores from the 2011 Arkansas Augmented Benchmark Exam. The covariates used within the study were the 2010 math and reading scores from the Arkansas Augmented Benchmark Exam. Analyses of Covariance (ANCOVAs) were run to test the four hypotheses. The results of these analyses are found in this chapter.

Hypothesis 1

Hypothesis 1 stated that after controlling for math achievement on the 2010 ACTAAP Augmented Benchmark Exam, no significant difference will exist by gender between fifth grade students in two intermediate schools within a suburban school district in Central Arkansas who were exposed to a combination of an online computer-assisted instructional program (PLATO) and small group instruction versus those who were exposed to the online program only on math achievement measured by the ACTAAP Augmented Benchmark Exam. The population from which the sample was taken was normally distributed. Three outliers were found within the sample groups. Outliers were deleted because they were simply different from the rest of the sample. Skewness showed a positive skew, and kurtosis data showed leptokurtosis. The Kolmogorov-Smirnov test yielded a significant result in reading, $KS = 0.02$ for the 2010 fifth grade male Instructional Strategy II indicating a non-normal distribution. However, data for the other three sample groups were normally distributed; and analysis of covariance is robust to violations of the normality assumption (Mertler & Vannatta, 2010). The researcher also ran Shapiro-Wilk, which showed data were distributed normally for all groups. Unadjusted and adjusted gender means for fifth grade 2011 Arkansas Augmented Math Benchmark Scale Scores, using 2010 Math scores as a covariate, are displayed in Table 1. As evident from this table, virtually no difference between males and females remains after controlling for 2010 Math.

Table 1

Unadjusted and Adjusted Fifth Grade Gender Means by Condition for Math Achievement Using 2010 Math Scores as a Covariate

	Unadjusted			Adjusted	
	N	*M*	*SD*	*M*	*SE*
Males by PLATO alone	49	619.41	58.52	623.93	7.34
Males by PLATO with HQT	50	656.92	64.46	640.92	7.48
Females by PLATO alone	49	620.71	61.08	633.74	7.47
Females by PLATO with HQT	49	650.57	55.84	649.35	7.32

Note. HQT = highly qualified teacher.

To test for homogeneity of variances prior to the data analysis, the Levene's test of equality of variances was conducted within ANCOVA and was not significant, $F(3,193) = .540$, $p = .655$. Therefore, the assumption of homogeneity of variances could be assumed (Mertler & Vannatta, 2010). A line plot of gender and instructional strategy indicated no interaction between factors. An analysis of covariance was used to assess whether fifth grade students in this sample scored higher on the 2011 Arkansas Augmented Benchmark Math Exam based on instructional strategy (PLATO without a highly qualified teacher or PLATO with a highly qualified teacher). The results of the ANCOVA are displayed in Table 2.

Table 2

Analysis of Covariance for Fifth Grade Math Achievement as a Function of Gender and Grade, Using 2010 Math Scaled Scores as a Covariate

Source	*SS*	*df*	*MS*	*F*	*Sig.*	*ES*
Math2010	192994.23	1	192994.23	73.56	.000	0.277
Gender	3957.76	1	3957.76	1.51	.221	0.008
Instruction	12156.57	1	12156.57	4.63	.033	0.024
Gen*Instr	23.17	1	23.17	0.01	.925	0.000
Error	503719.28	192	2623.54	503719.28		
Total	80691506.00	197				

Math 2010 was a significantly meaningful covariate, $F(1, 192) = 73.563$, $p < .001$, with a small partial eta squared effect size equal to 0.277. The interaction effect between gender and instruction was not statistically significant, F (1, 192) = .009, $p = .925$. Given there was no significant interaction between the independent variables, the main effect of each variable was examined separately. The main effect for gender was not statistically significant, $F(1, 192) = 1.509$, $p = .221$. The main effect for instruction was statistically significant, $F(1, 192) = 4.634$, $p = .033$, with a small partial eta squared effect size equal to 0.024.

Hypothesis 2

Hypothesis 2 stated that after controlling for math achievement on the 2010 ACTAAP Augmented Benchmark Exam, no significant difference will exist by gender between sixth grade students in two intermediate schools within a suburban school district in Central Arkansas who were exposed to a combination of an online computer-assisted instructional program (PLATO) and small group instruction versus those who were exposed to the online program only on math achievement measured by the ACTAAP Augmented Benchmark Exam. The population from which the sample was taken was normally distributed. Three outliers were found within the sample groups. Outliers were deleted because of their influence on normality (Mertler & Vanaata, 2010). Data for sample groups were normally distributed. Unadjusted and adjusted gender means for sixth grade 2011 Arkansas Augmented Math Benchmark Scale Scores, using 2010 Math scores as a covariate, are displayed in Table 3. As evident from this table, virtually no difference between males and females remains after controlling for 2010 Math scores.

Table 3

Unadjusted and Adjusted Sixth Grade Gender Means by Condition for Math Achievement Using 2010 Math Scores as a Covariate

	Unadjusted			Adjusted	
	N	*M*	*SD*	*M*	*SE*
Males by PLATO alone	49	675.12	58.52	680.53	7.01
Males by PLATO with HQT	50	706.51	64.46	691.12	7.24
Females by PLATO alone	49	659.16	61.08	678.09	7.26
Females by PLATO with HQT	49	711.54	55.84	701.68	7.20

Note. HQT = highly qualified teacher.

To test for homogeneity of variances prior to the data analysis, the Levene's test of equality of variances was conducted within ANCOVA and was not significant, $F(3,193) = 1.955$, $p = .122$. Therefore, the assumption of homogeneity of variances can be assumed (Mertler & Vannatta, 2010). A line plot of gender and instructional strategy indicated no interaction between factors. An analysis of covariance was used to assess whether sixth grade students in this sample scored higher on the 2011 Arkansas Augmented Benchmark Math Exam based on instructional strategy (PLATO without a highly qualified teacher or PLATO with a highly qualified teacher). The results of the ANCOVA are displayed in Table 4.

Table 4

Analysis of Covariance for Sixth Grade Math Achievement as a Function of Gender and Grade, Using 2010 Math Scaled Scores as a Covariate

Source	*SS*	*df*	*MS*	*F*	*Sig.*	*ES*
Math2010	217815.70	1	217815.70	89.42	.000	0.318
Gender	751.95	1	751.95	0.31	.579	0.002
Instruction	12445.84	1	12445.84	5.11	.025	0.026
Gen*Instr	2147.23	1	2147.23	0.88	.349	0.005
Error	467680.46	192	2435.84			
Total	93960113.00	197				

Math 2010 was a significantly meaningful covariate, $F(1, 192) = .89.42$, $p < .001$, with a medium partial eta squared effect size equal to 0.318. The interaction effect between gender and instruction was not statistically significant, $F(1, 192) = .88$, $p = .349$. Given there was no significant interaction between the independent variables, the main effect of each variable was examined separately. The main effect for gender was not statistically significant, $F(1, 192) = .31$, $p = .579$. The main effect for instruction was statistically significant, $F(1, 192) = 5.11$, $p = .025$, with a small partial eta squared effect size equal to 0.026.

Hypothesis 3

Hypothesis 3 stated that after controlling for reading achievement on the 2010 ACTAAP Augmented Benchmark Exam, no significant difference will exist by gender between fifth grade students in two intermediate schools within a suburban school district in Central Arkansas who were exposed to a combination of an online computer-assisted instructional program (PLATO) and small group instruction versus those who were exposed to the online program only on reading achievement measured by the ACTAAP Augmented Benchmark Exam. The population from which the sample was taken was normally distributed. Three outliers were found within the sample groups. Outliers were deleted because of their influence on normality (Mertler & Vannatta, 2010). Data for sample groups were normally distributed. Unadjusted and adjusted gender means for fifth grade 2011 Arkansas Augmented Reading Benchmark Scale Scores, using 2010 Reading scores as a covariate, are displayed in Table 5. As evident from this table, virtually no difference between males and females remains after controlling for 2010 Reading.

Table 5

Unadjusted and Adjusted Fifth Grade Gender Means by Condition for Reading Achievement Using 2010 Reading Scores as a Covariate

	Unadjusted			Adjusted	
	N	*M*	*SD*	*M*	*SE*
Males by PLATO alone	49	579.96	58.52	614.02	12.84
Males by PLATO with HQT	50	660.80	64.46	644.37	11.42
Females by PLATO alone	49	616.94	61.08	638.60	11.83
Females by PLATO with HQT	49	708.84	55.84	669.91	13.33

Note. HQT = highly qualified teacher.

To test for homogeneity of variances prior to the data analysis, the Levene's test of equality of variances was conducted within ANCOVA and was significant, $F(3,193)$ = 4.862, p = .003. Therefore, the assumption of homogeneity of variances cannot be assumed (Mertler & Vannatta, 2010). A line plot of gender and instructional strategy indicated no interaction between factors. An analysis of covariance was used to assess whether fifth grade students in this sample scored higher on the 2011 Arkansas Augmented Benchmark Reading Exam based on instructional strategy (PLATO without a highly qualified teacher or PLATO with a highly qualified teacher). The results of the ANCOVA are displayed in Table 6.

Table 6

Analysis of Covariance for Fifth Grade Reading Achievement as a Function of Gender and Grade, Using 2010 Reading Scaled Scores as a Covariate

Source	*SS*	*df*	*MS*	*F*	*Sig.*	*ES*
Read2010	168313.15	1	168313.15	27.88	.000	0.127
Gender	28406.08	1	28406.08	4.71	.031	0.024
Instruction	24608.20	1	24608.20	4.08	.045	0.021
Gen*Instr	11.39	1	11.39	0.00	.965	0.000
Error	1159117.65	192	6037.07			
Total	82912950.00	197				

Reading 2010 was a significantly meaningful covariate, $F(1, 192) = 27.88$, $p < .001$, with a small partial eta squared effect size equal to 0.127. The interaction effect between gender and instruction was not statistically significant, $F(1, 192) = .002$, $p = .965$. Given there was no significant interaction between the independent variables, the main effect of each variable was examined separately. The main effect for gender was statistically significant, $F(1, 192) = 4.71$, $p = .031$, with a small partial eta squared effect size equal to 0.024. In addition, the main effect for instruction was statistically significant, $F(1, 192) = 4.08$, $p = .045$, with a small partial eta squared effect size equal to 0.021.

Hypothesis 4

Hypothesis 4 stated that after controlling for reading achievement on the 2010 ACTAAP Augmented Benchmark Exam, no significant difference will exist by gender between sixth grade students in two intermediate schools within a suburban school district in Central Arkansas who were exposed to a combination of an online computer-assisted instructional program (PLATO) and small group instruction versus those who were exposed to the online program only on reading achievement measured by the ACTAAP Augmented Benchmark Exam. The population from which the sample was taken was normally distributed. Three outliers were found within the sample groups. Outliers were deleted because of their influence on normality (Mertler & Vannatta, 2010). Data for sample groups were normally distributed. Unadjusted and adjusted gender means for sixth grade 2011 Arkansas Augmented Reading Benchmark Scale Scores, using 2010 Reading scores as a covariate, are displayed in Table 7. As evident from this table, virtually no difference between males and females remains after 2010 Reading is controlled.

Table 7

Unadjusted and Adjusted Gender Means by Condition for Sixth Grade Reading Achievement Using 2010 Reading Scores as a Covariate

	Unadjusted			Adjusted	
	N	*M*	*SD*	*M*	*SE*
Males by PLATO alone	49	628.56	58.52	679.27	11.69
Males by PLATO with HQT	50	699.31	64.46	666.33	11.19
Females by PLATO alone	49	647.44	61.08	678.69	10.97
Females by PLATO with HQT	49	748.46	55.84	696.75	11.93

Note. HQT = highly qualified teacher.

To test for homogeneity of variances prior to the data analysis, the Levene's test of equality of variances was conducted within ANCOVA and was not significant, $F(3,193) = 2.329$, $p = .076$. Therefore, the assumption of homogeneity of variances can be assumed (Mertler & Vannatta, 2010). A line plot of gender and instructional strategy indicated interaction between factors. An analysis of covariance was used to assess whether sixth grade students in this sample scored higher on the 2011 Arkansas Augmented Benchmark Reading Exam based on instructional strategy (PLATO without a highly qualified teacher or PLATO with a highly qualified teacher). The results of the ANCOVA are displayed in Table 8.

Table 8

Analysis of Covariance for Sixth Reading Achievement as a Function of Gender and Grade, Using 2010 Reading Scaled Scores as a Covariate

Source	*SS*	*df*	*MS*	*F*	*Sig.*	*ES*
Read2010	534828.93	1	534828.93	97.09	.000	0.336
Gender	10595.87	1	10595.87	1.92	.167	0.010
Instruction	197.16	1	197.16	0.04	.850	0.000
Gen*Instr	11824.19	1	11824.19	2.15	.145	0.011
Error	1057678.04	192	5508.74			
Total	93157356.00	197				

Reading 2010 was a significantly meaningful covariate, $F(1, 192) = 97.087$, $p < .001$, with a medium partial eta squared effect size equal to 0.336. The interaction effect between gender and instruction was not statistically significant, $F(1, 192) = 2.146$, $p = .145$. Given there was no significant interaction between the independent variables, the main effect of each variable was examined separately. The main effect for gender was not statistically significant, $F(1, 192) = 1.923$, $p = .167$. The main effect for instruction was not statistically significant, $F(1, 192) = .036$, $p = .850$.

CHAPTER V

DISCUSSION

Parents, community members, and educators continually seek a greater variety of interventions within the schools to enable students to reach their highest academic achievement in the global world. Public educators need to develop and offer choices of interventions that will benefit individual student learning styles and improve academic achievement. Several current interventions use technology to appeal to a wide variety of learners at varied educational levels. Technology plays an important role in the world of education as a whole, and technological interventions have become a significant part of improving academic achievement. Trifiletti et al. (1984) believed technology-based learning or computer assisted instruction (CAI) enables students to have one-on-one interaction and offers them the opportunity to work at their own pace. They contended CAI has the potential as an instructional medium to individualize the learning process and enable students to learn more in less time. The USDOE (2009) found instruction combining CAI and face-to-face teacher facilitated instruction yielded greater results when compared to face-to-face instruction or CAI alone.

A substantial amount of research has been conducted on the PLATO software program. A few schools, using PLATO as a CIA Tier II intervention option, have asked if PLATO must be used in conjunction with a highly qualified teacher to improve academic achievement or if PLATO works equally well without the aid of a teacher. Although research exists on the use of PLATO by many school districts, little research addressed the main topic of this study within an intermediate school setting.

The intended goals of IDEAI, NCLB, and Race to the Top were to ensure high achievement for all students and to align curriculum, instruction, and assessment through emphasis on scientifically based research and accountability. The processes of Response to Intervention (RtI) has clear parallels to these goals with its own goals for high student achievement and the alignment of instruction, interventions, and assessment to promote student learning (Mellard & Johnson, 2008). This study provides a practical look at how one school district is attempting to make this goal of student achievement a reality. This study provides a practical look at how one school district is using a RtI problem-solving model to provide interventions and remediation. In an effort to improve student performance, schools can use similar interventions used in this study to help meet the requirements of IDEAI, NCLB, and Race to the Top.

This study examined, by gender, the academic effectiveness of using PLATO with or without a highly qualified teacher within a fifth and sixth grade intermediate suburban school setting within central Arkansas in both math and reading achievement. This chapter includes conclusions drawn from the findings. In addition, recommendations and implications are presented based on these conclusions.

Conclusions

To address the first and second hypotheses, two 2 x 2 factorial analysis of covariance (ANCOVAs) were conducted using instructional method (PLATO alone versus PLATO with a highly qualified teacher) and gender (male versus female) as the independent variables and math achievement as the dependent variable for the two different grade levels, fifth and sixth, respectively. The covariate was the 2010 math achievement scores on the ACTAAP Augmented Benchmark Exam. To address the third and fourth hypotheses, two 2 x 2 factorial ANCOVAs were conducted using instructional strategy (PLATO alone versus PLATO with a highly qualified teacher) and gender (male versus female) as the independent variables and reading achievement as the dependent variable for the two different grade levels, fifth and sixth, respectively. The covariate was the 2010 reading achievement scores on ACTAAP Augmented Benchmark Exam. Interaction effects and main effects were examined.

Hypothesis I

Hypothesis 1 stated after controlling for math achievement on the 2010 ACTAAP Augmented Benchmark Exam, no significant difference will exist by gender between fifth grade students in two intermediate schools within a suburban school district in Central Arkansas who were exposed to a combination of an online computer assisted instructional program (PLATO) and small group instruction versus those who were exposed to the online program only on math achievement measured by the ACTAAP Augmented Benchmark Exam. After analyzing the data, no significant interaction effect existed between the independent variables instructional strategy and gender on the dependent variable math achievement. Together, instructional strategy and gender did not significantly determine how students performed on the math ACTAAP Augmented Benchmark Exam. Based on these results, sufficient evidence did not exist to reject the null hypothesis for the interaction effect. For the main effect of gender, no significant difference on math achievement was found; however, a significant result was found in the main effect of instructional strategy. Therefore, evidence existed to reject the null hypothesis for instructional strategy.

The addition of a highly qualified teacher who did small group instruction in addition to the PLATO instruction made a significant difference in math achievement scores for at-risk fifth grade female students. Fifth grade female math students in the PLATO with a highly qualified teacher group scored 15.61 points higher than fifth grade female math students who were in the instructional group of PLATO only. Fifth grade male math students in the PLATO with a highly qualified teacher group scored 16.99 points higher than fifth grade male math students in the instructional group of PLATO only.

Research indicated that having a highly qualified teacher had a significant impact on student achievement (Rivkin, Hanushek, & Kain, 2005). Traynor (2003) found CAI improved regular and special education middle school students' mathematical achievement. In this study, a significant difference existed in the math achievement of at-risk fifth grade students who utilized PLATO with a highly qualified teacher compared to fifth grade students who utilized only PLATO as an instructional strategy. The findings for this hypothesis could be attributed to several factors. One contributing factor was the ability for each student to work one-on-one with the CAI as well as the highly qualified teacher. A second contributing factor was the addition of a highly qualified teacher with experience. Another contributing factor was the professional development of the highly qualified teachers on the use of PLATO as a Tier II instructional strategy for at-risk students, which the school district within this study provided to the participating highly qualified teachers.

Hypothesis 2

Hypothesis 2 stated after controlling for math achievement on the 2010 ACTAAP Augmented Benchmark Exam, no significant difference will exist by gender between sixth grade students in two intermediate schools within a suburban school district in Central Arkansas who were exposed to a combination of an online computer assisted instructional program (PLATO) and small group instruction versus those who were exposed to the online program only on math achievement measured by the ACTAAP Augmented Benchmark Exam. After analyzing the data, no significant interaction effect existed between the independent variables instructional strategy and gender on the dependent variable math achievement. Together, instructional strategy and gender did not significantly determine how students performed on the math ACTAAP Augmented Benchmark Exam. Based on these results, enough evidence did not exist to reject the null hypothesis for the interaction effect. For the main effect of gender, no significant difference on math achievement was found; however, a significant result was found in the main effect of instructional strategy. Therefore, evidence existed to reject the null hypothesis for instructional strategy.

The addition of a highly qualified teacher who did small group instruction in addition to the PLATO instruction made a significant difference in math achievement scores for at-risk sixth grade female students. Sixth grade female math students who were in the instructional group, PLATO with a highly qualified teacher, scored 23.59 points higher than sixth grade female math students who were in the instructional group of PLATO only. Sixth grade male math students who were in the instructional group, PLATO with a highly qualified teacher, scored 10.59 points higher than sixth grade male math students who were in the instructional group of PLATO only.

Rivkin et al., (2005) argued research has shown teachers benefit from experience. In addition, the observed research demonstrates the positive impact a highly qualified experienced teacher can have on at-risk students' academic achievement. In this study, the addition of a highly qualified teacher with experience made a significant difference in the math achievement of at-risk sixth grade students who utilized PLATO. The findings for this hypothesis could be attributed to the following factors. One contributing factor for the results within this study was that participating teachers had around 20 years of experience. Another contributing factor was that all the teachers involved in the study were highly qualified in the areas of math and reading at the fifth and sixth grade levels. These teachers had certification to teach these core subject areas as well as having numerous hours of professional training within these subject areas at the time of the study.

Hypothesis 3

Hypothesis 3 stated after controlling for reading achievement on the 2010 ACTAAP Augmented Benchmark Exam, no significant difference will exist by gender between fifth grade students in two intermediate schools within a suburban school district in Central Arkansas who were exposed to a combination of an online computer assisted instructional program (PLATO) and small group instruction versus those who were exposed to the online program only on reading achievement measured by the ACTAAP Augmented Benchmark Exam. After analyzing the data, no significant interaction effect existed between the independent variables of instructional strategy and gender on the dependent variable of reading achievement. Together, instructional strategy and gender did not significantly determine how students performed on the reading ACTAAP Augmented Benchmark Exam. Based on these results, enough evidence did not exist to reject the null hypothesis for the interaction effect. For the main effect of gender, a significant difference on reading achievement was found. Therefore, evidence existed to reject the null hypothesis for gender. For the main effect of instructional strategy, a significant difference on reading achievement was found. Therefore, evidence existed to reject the null hypothesis for instructional strategy.

The main effect for gender was statistically significant. Fifth grade at-risk females in the instructional group, PLATO, scored 31.31 points higher than fifth grade male students within the same group. Fifth grade at-risk males in the instructional group, PLATO with a highly qualified teacher, scored 30.35 points higher than fifth grade male students within the same group. In addition, the main effect for instruction was also statistically significant. A highly qualified teacher who did small group instruction in addition to the PLATO instruction made a significant difference in reading achievement scores for at-risk fifth grade students. Although both instructional groups improved in mean test scores, fifth grade female reading students who were in the instructional group, PLATO with a highly qualified teacher, scored 91.9 points higher than fifth grade female reading students in PLATO only instructional group. Although both instructional groups for males improved in mean test scores, fifth grade male reading students in the instructional group, PLATO with a highly qualified teacher, scored 80.86 points higher than fifth grade male reading students who were in the instructional group of PLATO only.

Within this study, a significant difference existed in the reading achievement of at-risk fifth grade students based on gender. One contributing factor of this is indicated by research. Studies have suggested differences in the achievement of females and males in the area of reading. Historically, females have tended to perform better on reading tests (Willingham & Cole, 1997). Although tests of general intelligence suggest no overall difference between females and males, large differences by gender are apparent in assessment scores on specific cognitive tests showing females tend to excel verbally, and males do better on spatial and visual tasks (Dee, 2005). Research from the 2005 National Assessment of Educational Progress report found females scored 12% higher than males on reading achievement tests (Baer, Baldi, Ayotte, & Green, 2007; O'Sullivan, Brown, & Jones, 2004; Taylor, 2004). Another contributing factor was the addition of highly qualified teachers with experience in the content areas of math and reading. In this study, a significant difference existed in the reading achievement of at-risk fifth grade students who used PLATO with a highly qualified teacher versus fifth grade students who utilized PLATO only.

Hypothesis 4

Hypothesis 4 stated after controlling for reading achievement on the 2010 ACTAAP Augmented Benchmark Exam, no significant difference will exist by gender between sixth grade students in two intermediate schools within a suburban school district in Central Arkansas who were exposed to a combination of an online computer assisted instructional program (PLATO) and small group instruction versus those who were exposed to the online program on reading achievement measured by the ACTAAP Augmented Benchmark Exam. After analyzing the data, no significant interaction effect existed between the independent variable instructional strategy and gender on the dependent variable of reading achievement. Together, instructional strategy and gender did not significantly determine how students performed on the math ACTAAP Augmented Benchmark Exam. Based on these results, enough evidence did not exist to reject the null hypothesis for the interaction effect. For the main effect of gender, no significant difference on reading achievement was found. For the main effect of instructional strategy, no significant difference on reading achievement was found. Based on these results, enough evidence did not exist to reject the null hypothesis for the main effect of gender or the main effect of instructional strategy.

The addition of a highly qualified teacher who did small group instruction in addition to the PLATO instruction did not make a significant difference in reading achievement scores for at-risk sixth grade students. Sixth grade female reading students in the instructional group, PLATO with a highly qualified teacher, scored 18.06 points higher than sixth grade female reading students who were in the instructional group of PLATO only. Sixth grade male reading students in the instructional group, PLATO with a highly qualified teacher scored 12.94 points lower than sixth grade male reading students who were in the instructional group of PLATO only.

Hypothesis 4 was the only hypothesis where no significant difference on the main effect of instructional strategy was found. Although on the average females scored higher with the addition of the highly qualified teacher, males on the average scored better with the computer program of PLATO without the highly qualified teacher. Dee (2005) acknowledged research shows that males perform better with visual and spatial skills than females. Therefore, in this study of sixth graders as compared to the current research, the type of instructional strategy was not a contributing factor in academic reading achievement. Although the females did score better with the highly qualified teacher, the mean of the two genders made the overall effect non- significant.

Recommendations

Sanders and Rivers (1996) asserted that highly qualified teachers engage students and inspire them to academic excellence. The authors suggested these teachers are distinguished deliverers of content and instructional strategies. Therefore, based on the research, the following recommendations are offered. First, intervention teachers should hold a highly qualified status within the area they are teaching. Along with highly qualified status, the teacher should be required to participate in on-going professional development to ensure they are current on intervention strategies and instructional strategies within the core content.

Second, because states need to focus on the academic achievement of students who are not reaching proficiency based on local, state, and national standards, administrators and teachers should continue to learn about instructional and intervention strategies to help at-risk students meet grade level standards. In this study, consideration was given to students who were considered at-risk.

Third, based upon the second recommendation, all school districts need to set up an RtI model complete with a problem-solving team as prescribed by the literature. The RtI model would ensure students were given interventions within the classroom, as well as more intensive interventions when needed. The problem-solving teams would look at data to determine when and in what specific areas students have weaknesses. The teams would then determine when students need more intensive interventions as required by the RtI model.

Implications

Significance and Expansion of Knowledge Base

Fulton (1998) believed the effectiveness of educational technology on student learning depends not only on academic outcomes but on how technology is integrated into instruction and how teachers assess student performance and adjust instruction accordingly. This study provides quantitative research on the effects of PLATO as a Tier II intervention for at-risk students combined with or without a highly qualified teacher on both math and reading achievement of fifth and sixth grade students scoring below proficient or just above proficiency on the ACTAAP Augmented Benchmark Exam. Based on the results, educators have an additional resource to improve Tier II intervention for at-risk students in both math and reading achievement with the addition of a qualified teacher. Data accumulated in this study adds to the body of evidence on the usefulness of Tier II intervention practices in general, the usefulness of PLATO as one of the interventions in particular, and the need for highly qualified teachers being a part of CAI interventions. In 3 out of 4 hypotheses, data collected provides documentation supporting the positive effects of PLATO as a CAI intervention to improve student achievement, specifically for at-risk students. The results of this study provided information on PLATO as a CAI to further both differentiated instruction as well as Tier II interventions. The results of this study also indicated how the addition of a highly qualified instructor is an important indicator of student academic success. The at-risk students who received the instructional strategy of PLATO with a highly qualified teacher scored significantly higher on academic achievement.

The results of the standardized testing also showed within fifth grade that 90% of the at-risk students in math and 95% of the students in reading who received the addition of the highly qualified teacher scored proficient on the grade level 2011 ACTAAP Augmented Benchmark Exam. The results of the standardized testing also showed within fifth grade that 79% of the students in math and 75% of the students in reading who received the instructional strategy of PLATO alone scored proficient on the grade level 2011 ACTAAP Augmented Benchmark Exam. Although 96% of all at-risk students within the study did show academic growth despite the instructional strategy, 4% of the at-risk fifth grade students were found to be in need of further interventions or testing for special education services in both academic areas.

The results of the standardized testing also showed within sixth grade that 95% of the students in math and 93% of the students in reading who received the addition of the highly qualified teacher scored proficient on the grade level 2011 ACTAAP Augmented Benchmark Exam. The results of the standardized testing also showed within sixth grade that 90% of the students in math and 74% of the students in reading who received the instructional strategy of PLATO alone scored proficient on the grade level 2011 ACTAAP Augmented Benchmark Exam. Although 97% of all students within the study did show academic growth despite the instructional strategy, 3% of the at-risk sixth grade students were found to be in need of further interventions or testing for special education services in both academic areas.

The results of this study showed significant differences in math and reading achievement based on CAI Tier II interventions within the first year. Southwest Educational Development Laboratory (SEDL, 2007) stated RtI was developed based on the belief all children can learn, and educators are responsible for identifying and fostering conditions that promote learning for all children. Through RtI and Tier I and II interventions, 95% of students should be able to obtain academic grade level objectives. SEDL did not develop a specified time period for achieving these results as long as the students continue to make academic improvement and no learning disability is found. If students make the necessary progress, they continue with their same level of interventions. The results of this study found PLATO as a CAI Tier II intervention did make improvements in the math and reading scores on the 2011 ACTAAP Augmented Benchmark Exam for both fifth and sixth grade students. When PLATO was combined with a highly qualified teacher who did individualized interventions and small group instruction, then the results were significant in three of the four cases.

This study had several strengths. First, it used the covariates of the 2010 ACTAAP Augmented Benchmark Exam math and reading scores to adjust for preexisting conditions within the participants of the study. Second, the study used equal numbers of both gender and grade level tested within each instructional strategy, which enabled the two variances to be assumed (Mertler & Vannatta, 2010). In addition, both instructional groups used PLATO as a CIA intervention, and the results of the study showed all groups showed improvement in both math and reading scores on the 2011 ACTAAP Augmented Benchmark Exam, though one was not statistically significant. The results of this research added to the growing body of research in both RtI and CAI interventions. This research also extends the research on RtI and CAI interventions within an intermediate school setting.

Future Research Considerations

This study can be used as the framework and inspiration for future research regarding the implementation of RtI models and different CAI Tier II intervention options. Because this study examined the experiences of a suburban school district within central Arkansas and dealt with students within the fifth and sixth grade, future studies should examine other populations of interest to determine the experiences of those under the same conditions. In addition, other populations should include those outside of the geographic region of the sample and populations that differ in education level.

This study has focused on a small portion of interventions, which can aid student academic achievement. In general, factors contributing to learning using CAI have been well established in the literature. However, evidence specifically related to PLATO as a CAI, Tier II intervention on student achievement in the areas of math and reading is minimal. In addition, a lack of data-based research exists showing the impact of CAI combined with quality teacher instruction. Although some may believe that CAI is a stand-alone solution to remediation problems, EFA Global Monitoring Report (2005) noted learning through performance requires active discovery, analysis, interpretation, problem solving, memory, and physical activity. This type of instruction still seems to require the combination of CAI strategies and high quality teacher instruction. This mode of instruction aids in cognitive learning and helps the student in the direction of creative and emotional development. Experienced, highly qualified teachers deliver many subtle messages and important lessons in such classrooms that might be diminished in other types of learning (Donlevy, 2003). This study validated this research with its sample population, but further studies need to be done within other grade levels, geographical locations, diverse student population, and sample population sizes to further validate the results.

Further examination of teachers' understandings of the components of RtI could be studied by determining if teachers can identify the criteria an intervention must meet in order to be considered research-based and if they can identify research-based interventions they use personally or that are used within their districts. In addition, future research can study different models of RtI that use CAI as a Tier II intervention. Intervention plans and data progress monitoring of the problem solving teams as well as how teams use data to determine intervention levels and special education testing can also be studied. Another area for exploration is how well administrators (principals, superintendents, curriculum specialists, and special education coordinators) and teachers understand RtI and its implementation, how to effectively implement the process, and how to provide evidence-based professional development for staff to gain academic achievement for at-risk students.

Additional research could examine how each district determines achievement level cutoffs, fidelity checks, and adequate progress. It is likely that differences in these choices influence the results seen in various schools and districts. It would also be meaningful to examine the decision-making processes used to choose the ways in which each school would determine each of these. Future studies could be done recording the number of students found to be eligible for special education services within the first year or two of CAI intervention implementation.

Students who struggle due to disabilities must be appropriately identified and interventions must be attempted to aid them. Educators have a legal and ethical duty to identify struggling students, provide research-based interventions, study the responses of students to those interventions, and use the data collected to best meet the needs of the learners so they can be as successful as possible in school. More research should be conducted to further investigate and validate this field of research to ensure interventions are appropriate for students. Educators need to ensure that students within their classrooms, schools, or districts are growing academically. Therefore, interventions must be used to ensure this academic growth is made.

Potential Policy Change

RtI is now a part of the national conversational. Educators and society in general are looking for different types of interventions to improve academic achievement for all students. Society demands individuals receive a quality education, especially within the core content classes of math and reading. With these demands, educators and policy-makers are constantly seeking avenues to improve academic achievement, specifically in math and reading. CAI has been touted as one positive intervention option. However, from the beginning of students' formal education, highly qualified teachers are at the forefront in addressing the academic needs of students within the classroom. They must make the daily decisions to meet the students where they are when entering their classrooms for the first time. Teachers need appropriate intervention choices to increase the success rate of all students.

First, to meet the challenges of a changing society and meet the academic needs of a diverse school population, school districts need to evaluate the programs in place to ensure they are meeting the differentiated needs of their school population. Students who are labeled at-risk due to low academic scores on achievement tests must be targeted for a more intense level of instruction to ensure they achieve academic growth. School districts need to place teachers of the highest quality to work with these students.

Second, schools should provide individualized instruction to all students who are considered at-risk. This is difficult to do within a large group setting. School districts will need to offer interventions outside the regular classroom to meet the academic needs of these students in a more intense way. CAI offers school districts an avenue to individualize instruction for these students. When a school district combines CAI with a highly qualified teacher with experience who can work with the students individually on their areas of weakness, academic growth does and will happen.

REFERENCES

Adams, M. J. (2009). The challenge of advanced texts: The interdependence of reading and learning. In E. H. Hiebert (Ed.), *Reading More, Reading Better* (pp. 163–189). New York, NY: Guilford.

Allan, S. D., & Goddard, Y. L. (2010). Differentiated instruction and RtI: A natural fit. *Educational Leadership*, *68*(2), 60-68.

Allbritten, S. F., Mainzer, R., & Zeigler, D. (2004). Will students with disabilities be scapegoats for school failures? *Teaching Exceptional Children*, *36*(3), 73-75.

Al Otaiba, S., & Fuchs, D. (2006). Who are the young children for whom best practices in reading are ineffective? An experimental and longitudinal study [Online Version]. *Journal of Learning Disabilities*, *39*, 414 – 431.

American Institutes for Research. (n.d.). *National Center on Response to Intervention*. Retrieved from http://www.rti4success.org/subcategorycontents

Amoroso, G., Douglas, S., Cronin, D., & Molesky, J. (2010). *Lakeville South math intervention. PLATO*. Retrieved from www.plato.com/sites/default/files/MC372%20Lakeville%20Case%20Study.pdf

Anderson, R. C., Hiebert, E. H., Scott, J. A., & Wilkinson, I. A. G. (1985). *Becoming a nation of readers.* Washington, DC: US Department of Education, The National Institute of Education.

Approach, U. A., Record, S. P., & Attend, S. T. (2006). *Teacher quality and student achievement*. Retrieved from http://www.education.com/reference/article/Ref_Research_Q_consider/

Ardoin, S.P. (2006). The response in response to intervention: Evaluating the utility of assessing maintenance of intervention effects. *Psychology in the Schools, 43*, 713-725.

Ardoin, S. P., Witt, J. C.; Connell, J. E., & Koenig, J. L. (2005). Application of a three-tiered response to intervention model for instructional planning, decision making and the identification of children in need of services. *Journal of Psychoeducational Assessment, 23,* 362-380.

Arkansas Department of Education. (2001). *Arkansas Department of Education: Rules and regulations governing the intervention block grant program*. Retrieved from arkansased.org/about/pdf/current/ade_121_block_grant.pdf

Arkansas Department of Education. (2010). *Arkansas Department of Education: Testing.* Retrieved from http://arkansased.org/testing/pdf/assessment/benchmark_rawtoscale_052110.pdf

Arkansas Department of Education/Testing. (2010). *Arkansas Department of Education: Definitions*. Retrieved from http://arkansased.org/testing/definitions.html

Arkansas Department of Education. (2011). *Arkansas Department of Education Testing: Raw to scale scores on 2011 augmented benchmark exam*. Retrieved from http://arkansased.org/testing/pdf/assessment/benchmark_rawtoscale_052110.pdf

At-Risk Students Law & Legal Definition. (2010). *Legal definitions legal terms dictionary*. Retrieved from http://definitions.uslegal.com/a/at-risk-students/

Babbitt, B. C., & Miller, P. S. (1996). Using hypermedia to improve the mathematics problem-solving skills of students with learning disabilities. *Journal of Learning Disabilities, 29,* 391-401.

Baer, J., Baldi, S., Ayotte, K. & Green, P. J. (2007). *The reading literacy of U.S. fourth-grade students in an international context results from the 2001 and 2006 progress in international reading literacy study (PIRLS)*. Retrieved from United States Department of Education, Institute of Education Sciences website: http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2008017

Bahr, C., & Rieth, H. (1989). The effects of instructional computer games and drill and practice software on learning disabled students' mathematics achievement. *Computers in the Schools, 6,* 87-101.

Barley, Z; Lauer, P. A., Arens, S. A., Apthrop, H. S., Englert, K. S., Snow, D., & Akiba, M. (2002). *Helping at-risk students meet standards: A synthesis of evidence-based classroom practices*. Centennial, CO: Mid-continent Research for Education and Learning.

Batsche, G., Curtis, J., Dorman, C., Castillo, J., & Porter, L. J. (2008). The Florida problem solving/response to intervention model: Implementing a statewide initiative. In S. Jimerson, M. Burns, & A. VanDerHeyden (Eds.), *Handbook of response to intervention: The science and practice of assessment and intervention* (pp. 378–395). New York, NY: Springer.

Benard, B. (1995). Fostering resiliency in urban schools. In B. Williams (Ed.), *Closing the achievement gap: A vision to guide change in beliefs and practice*. Oak

Brook, IL: Research for Better Schools and North Central Regional Educational Laboratory.

Berry, B. (2002). *What it means to be a highly qualified teacher*. Carrboro, NC: Southeast Center for Teacher Quality. Retrieved from http://www.teachingquality.org/pdfs/definingHQ.pdf

Berthold, H. C. & Sachs, R. H. (1974). Education of the minimally brain damaged child by computer and by teacher. *Programmed Learning and Educational Technology, 11,* 121-124.

Boces, E., & Mellard, D. (2009). *Response to intervention: Research and best practice. Jump starting the RtI process in your school.* Retrieved from www.nysrti.org/docs/D_Mellard_ppt_OCT_14_09.pdf

Bradford, M. (2005). Motivating students through project-based service learning [Online Version]. *T.H.E. Journal, 32*(6), 29-30. Retrieved from EBSCO host database.

Brown-Chidsey, R., & Steege, M. (2005). *Response to intervention: Principles and strategies for effective practice.* New York, NY: Guilford Press.

Buffman, A., Mattos, M., & Weber, C. (2010). The Why Behind RtI. *Educational Leadership, 68*(2), 10-16. Retrieved from http://www.ascd.org/publications/educational-leadership/oct10/vol68/num02/The-Why-Behind-RTI.aspx

Burns, M. K., Appleton, J. J., & Stehouwer, J. D. (2005). Meta-analytic review of responsiveness-to-intervention research: Examining field-based and research-implemented models. *Journal of Psychoeducational Assessment, 23,* 381-394.

Butler, F. M., Miller, S. P., Crehan, K., Babbitt, B., & Pierce, T. (2003). Fraction instruction for students with mathematics disabilities: Comparing two teaching sequences. *Learning Disabilities Research & Practice*, *18*(2), 99-111.

Caggiano, J. A. (2007). *Addressing the learning needs of struggling adolescent readers: The impact of a reading intervention program on students in a middle school setting.* Unpublished doctoral dissertation, The College of William and Mary, Williamsburg, VA.

Catts, H. W., Fey, M. E., Zhang, X., & Tomblin, J. B. (1999). Language basis of reading and reading disabilities. *Journal of Speech and Hearing Research, 36,* 948-958.

Catts, H. W., & Kamhi, A. (Eds.). (2005). *Language and reading disabilities* (2nd ed.). Boston, MA: Pearson Education.

Chetty, R., Friedman, J., & Rockoff, J. (2011). *The long-term impacts of teachers: Teacher value added and student outcomes in adulthood*. Retrieved from http://www.obs.rc.fas.harvard.edu/chetty/value_added

Chi, M. T. (2009). Active-constructive-interactive: A conceptual framework for differentiating learning activities. *Topics in Cognitive Science*, *1*, 73–105.

Christ, T. J., & Poncy, B. C. (2005). Guest editor's introduction to a special issue on response to interventions. *Journal of Psychoeducational Assessment*, *23*, 299-303.

Chun, M., & Witt, J. (2008). *System to enhance educational performance*. Retrieved from http://www.isteep.com/index.html

Cole, R. W. (2008). *Educating everybody's children diverse teaching strategies for diverse learners* (Rev. and expanded 2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development.

Coleman, M. R., Buysse, V., & Neitzel, J. (2006). *Recognition and response: An early intervening system for young children at-risk for learning disabilities* (*Full report).* Chapel Hill, NC: The University of North Carolina at Chapel Hill, FPG Child Development Institute.

Cooper, G., & Sweller, J. (1987). Effects of schema acquisition and rule automation on Mathematical problem-solving transfer. *Journal of Educational Psychology, 79,* 347-362.

Corcoran, C. A., & Davis, A. D. (2005). A study of the effect of readers' theater on second And third grade special education students' fluency growth. *Reading* Improvement, *42*(2), 105-111.

Cortiella, C. (2006). *NCLB and IDEA: What parents of students with disabilities need to know and do.* Retrieved from LD OnLine website: http://www.ldonline.org/article/11846

Council for Exceptional Children. (2011). *Passion vs. compulsion: National Board Certification and federal "highly qualified" teacher mandates*. Retrieved from http://www.cec.sped.org/AM/Template.cfm?Section=Home&TEMPLATE=/CM/ContentDisplay

Countinho, M., & Oswald, D. (2004). *Disproportionate representation of culturally and linguistically diverse students in special education: measuring the problem* [Practitioner Brief Series]. Denver, CO: National Center for Culturally Responsive Educational Systems. Retrieved from http://www.nccrest.org/Briefs/students_in_SPED_Brief.pdf

Cromey, A., & Hanson, M. (2000). *An exploratory analysis of school-based student assessment systems*. Retrieved from North Central Regional Educational Laboratory website: http://www.ncrel.org/policy/pubs/html/data/index.html

Dear, B. (2010). *PLATO history*. Retrieved from http://PLATOhistory.org

Dee, T. S. (2005). *Teachers and the gender gaps in student achievement* [Working Paper #11660]. Retrieved from National Bureau of Economic Research website: http://www.nber.org/papers/w11660

Donlevy, J. (2003). Online learning in virtual high school: Teachers, technology and training. *International Journal of Instructional Media; 30*(2), 22-26.

Duncan, A. (2011). Duncan: 82 percent of schools could be 'failing' this year. Retrieved from Education Week: Blogs website: http://blogs.edweek.org/

Duran, G., & Diamond, T. (2010). *Essential components of RtI: A closer look at response to intervention*. Washington, DC: National Center on the Response to Intervention.

EFA Global Monitoring Report. (2005). *Chapter 1: Understanding education quality*. Retrieved from EFA Global Monitoring Report website: http://www.unesco.org/new/en/education/themes/leading-the-international-agenda/efareport/ 2005

Ernst, L., Miller, B., Robinson, W., & Tilly, W. D. (2005, November). *Response to intervention: A case illustration.* Presentation at the National Association of State Directors of Special Education, Washington, DC.

Faggella-Luby, M., & Deshier, D. (2008). Reading comprehension in adolescents with LD: What we know; what we need to learn. *Learning Disabilities Research & Practice*, *23*(2), 70.

Fairbanks, S., Sugai, G., Guardino, D., & Lathrop, M. (2007). Response to intervention: Examining classroom behavior support in second grade. *Exceptional Children, 73*, 288-310.

Fletcher-Flinn, C. M., & Gravatt, B. (1995). The efficacy of computer-assisted instruction (CAI): A meta-analysis. *Journal of Educational Computing Research*, *32*, 219-241.

Frederick, L. R., & Shaw, E. L. (1998). *Examining the effects of science manipulatives on achievement, attitudes, and journal writing of elementary science students*. Retrieved from http://www.eric.ed.gov/

Fuchs, D., & Fuchs, L. S. (1998). Researchers and teachers working together to adaptinstruction for diverse learners. *Learning Disabilities Research and Practice*, *13*, 126-137.

Fuchs, D., Fuchs, L. S., & Vaughn, S. (2008). *Response to intervention: A framework for reading educators.* Newark, DE: International Reading Association.

Fuchs, D., Mock, D., Morgan, P., & Young, C. (2003). Responsiveness-to-intervention: Definitions, evidence, and implications for the learning disabilities construct. *Learning Disabilities: Research and Practice*, *18*, 157–171.

Fuchs, L. S., Compton, D. L., Fuchs, D., Paulsen, K., Bryant, J. D., & Hamlett, C. L. (2005). The prevention, identification, and cognitive determinants of math difficulty. *Journal of Educational Psychology, 97*, 493-513.

Fuchs, L. S., & Fuchs, D. (2006). Implementing responsiveness to intervention to identify learning disabilities. *Perspectives on Dyslexia, 32*(1), 39–43.

Fuchs, L. S., & Fuchs, D. (2007). Instruction on mathematical problem solving. In D. Berch & M. Mazzacco (Eds.), *Why Is Math So Hard For Some Children? The Nature and Origins of Mathematical Learning Difficulties and Disabilities* (pp. 397-414). Baltimore: Brookes.

Fulton, K. (1998). *A research study: A framework for considering technology's effectiveness*. Indianapolis, IN: Retrieved from Indiana Department of Education website: http://ideanet.doe.state.in.us/olr/pdf/appresearchkful.pdf

Gaddy, J. S. (2007). *The influence of technology-based instruction on student learning, motivation and teacher perceptions toward science instruction* (Unpublished educational specialist thesis). Valdosta University, Valdosta, GA. Retrieved from http://chiron.valdosta.edu/are/Vol6no1/PDF%20Articles/Janet_S_Gaddy_Thesis.pdf

Gay, L., Mills, G., & Airasian, P. (2009). *Educational research competencies for analysis & applications.* Columbus, OH: Merill.

Gersten, R. (1998). Recent advances in instructional research for students with learning disabilities: An overview. *Learning Disabilities Research and Practice, 13,* 162-170.

Gersten, R., Baker, S., & Lloyd, J. W. (2000). Designing high-quality research in special education: Group experimental designs. *Journal of Special Education Research, 34,* 145-148.

Gersten, R., Beckmann, S., Clarke, B., Foegen, A., Marsh, L., Star, J. R., & Witzel, B. (2009). *Assisting students struggling with mathematics: Response to intervention (RTI) for elementary and middle schools* (NCEE 2009-4060). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, United States Department of Education. Retrieved from http:// ies.ed.gov/ncee/wwcpublications/practiceguides/

Gersten, R., Fuchs, L., Williams, J., & Baker, S. (2001). Teaching reading comprehension to students with learning disabilities: A review of research. *Review of Educational Research, 71,* 279-320.

Goin, L., Hasselbring, T., & McAfee, I. (2004). *Executive summary, DoDEA/Scholastic READ 180 project: An evaluation of the READ 180 intervention program for struggling readers*. New York, NY: Scholastic Research and Evaluation Department.

Goldman, S. R., Pellegrino, J. W., & Mertz, D. L. (1999). Extended practice of basic addition facts: Strategy changes in learning disabled students. *Cognition and Instruction, 5*, 223-265.

Gresham, F. M. (2001). *Responsiveness to intervention: An alternative approach to the identification of learning disabilities*. Lecture conducted from National Research Center on Learning Disabilities, Learning Disabilities Summit.Washington, DC.

Gresham, F. M. (2004). Current status and future directions of school-based behavioral interventions. *School Psychology Review, 33,* 326-343.

Grouws, D., & Cebulla, K. (2000). *Improving student achievement in mathematics. Part 1:Research findings*. Retrieved from http://www.stemworks.org/digests/dse00-09.html

Hale, J. (2006). Implementing IDEA 2004 with a three-tier model that includes response to intervention and cognitive assessment methods. *NASP Research in Practice, 1*(1), 16-27. Retrieved from http://www.nasponline.org/publications/spf/issue1/haleabstract.aspx

Hallahan, D., & Mercer, C. (2002). Learning disabilities: Historical perspectives. In R. Bradley, L. Danielson, & D. Hallahan (Eds.), *Identification of learning disabilities: Research to practice* (pp. 1-67). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Haycock, K. (1998). *Good teaching matters, thinking K-16*. Washington, DC: The Education Trust.

Heubert, J. P., & Hauser, R. M. (1998). *High stakes: Testing for tracking, promotion, and graduation*. Washington, DC: National Academy Press.

Hiebert, J., & Carpenter, T. P. (1992). Learning and teaching with understanding. In D. Grouws (Ed.), *Handbook for research on mathematics teaching and learning* (pp. 65-97). New York, NY: Macmillan.

Honey, M. (2004). *Critical issue: Using technology to improve student achievement.* Retrieved from North Central Regional Educational Laboratory website: http://www.ncrel.org/sdrs/areas/issues/methods/technlgy/te800.html

Hoover, J. J. (2005). *National implementation of response to intervention (RtI), research summary.* Alexandria, VA: NASDE.

Hudson, R. F., Lane, H. B., & Pullen, P. C. (2005). Reading fluency assessment and instruction: What, why, and how? *The Reading Teacher*, *58*(8), 702-714.

Hung, J., Randolph-Seng, B., Monsicha, K., & Crooks, S. M. (2008). Computer-based instruction and cognitive load. *Academic Exchange Quarterly*, *12*(4), 207-221.

International Association for K-12 Online Learning (INACOL). (2010). *An Exploration of At-risk Learners and Online Education*. Retrieved from International Association for K-12 Online Learning website: http://www.iiNACOL.org/research/docs/iINACOL_CreditRecovery.pdf

Individuals with Disabilities Education Act (IDEA). Public Law 101-476. 20 USC §1400 et seq (1990).

Jackson, S. (2008). *Translating on-ground courses into effective online education*. Retrieved from http://www.facultyfocus.com/articles/translating-on-ground-courses-into-effective-online-education/

Johnson, B., & Christensen, L. (2008). *Education research: Quantitative, qualitative, and mixed approaches* (3rd ed.). Los Angeles, CA: Sage.

Johnson, E. S., Mellard, D. F., Fuchs, D., & McKnight, M. (2006). *Response to intervention: How to do it.* Lawrence, KS: National Research Center on Learning Disabilities.

Johnson, K. (2000). *Do computers in the classroom boost academic achievement*? Retrieved from Conservative Policy Research and Analysis website: http://www.heritage.org/research/reports/2000/06/do-computers-in-the-classroom-boost-academic-achievement

Johnson, L., Graham, S., & Harris, K. R. (1997). The effects of goal setting and self-Instruction on learning a reading comprehension strategy: A study of students with learning disabilities. *Journal of Learning Disabilities, 30*(1), 80-91.

Joint Committee on Standards for Educational and Psychological Testing of the AERA, APA, and NCME. (1999). *Standards for educational and psychological testing*. Washington, DC: American Educational Research Association.

Kame'enui, E. J., Carnine, D. W., Dixon, R. C., Simmons, D. C., & Coyne, M. D. (2002). *Effective teaching strategies that accommodate diverse learners* (2nd ed.). Upper Saddle River, NJ: Merrill Prentice Hall.

Kay, K., & Honey, M. (2005). *Beyond technology competency: A vision of ICT literacy to prepare students for the 21st century*. Charleston, WV: Evantia.

Kinder, D., & Stein, M. (2006). Quality mathematics programs for students with disabilities. In M. Montague & A. K. Jitendra (Eds.), *Teaching mathematics to middle school students with learning difficulties* (pp. 133-153). New York, NY: The Guilford Press.

Kirk, S. (1962). *Educating exceptional children*. Boston, MA: Houghton Mifflin.

Kozol, J. (2005). *The shame of the nation: The restoration of apartheid schooling in America.* New York, NY: Three Rivers Press.

Krotofil, M. D. (2006). *A Comparison of the effect of Scholastic Read 180 and Traditional Reading Interventions on the Reading Achievement of Middle School Low Level Readers.* Unpublished Educational Specialist Thesis from Central Missouri State University, Warrensburg, MO.

Kuhn, M. R. (2009). *The hows and whys of reading fluency*. Boston, MA: Allyn & Bacon.

Kuhn, M. R., Schwanenflugel, P. J., Morris, R. D., Morrow, L. M., Woo, D., Meisinger, B., Sevcik, R., Bradley, B., & Stahl, S. A. (in memoriam). (2006). Teaching children to become fluent and automatic readers. *Journal of Literacy Research, 38*, 357-387.

Kulak, J. A. (1994). Meta-analytic studies of findings on computer-based instruction. In E. Baker & H. O'Neil (Eds.), *Technology Assessment in Education and Training.* Hillsdale, NJ: Erlbaum.

Kulak, C., & Kulak, J. A. (1991). Effectiveness of computer-based instruction: An updated analysis. *Computers in Human Behavior*, *7*, 75-94.

Learning Disabilities Association. (2005). *Responsiveness to intervention and learning disabilities.* Retrieved from http://www.ldanatl.org/

Learning Disabilities of America. (1998). *Reading methods and learning disabilities*. Retrieved from http://www.ldanatl.org/aboutld/teachers/teaching_reading/reading_methods.asp

Learning Disabilities of the World. (2010). *How does RtI help students with learning or other disabilities. learning disabilities worldwide*. Retrieved from www.ldworldwide.org/pdf/rti/rti-series-2-how-does-rti-help.pdf

Legters, N., McDill, E., & McPartland, J. (1994). Section II: Rising to the challenge: Emerging strategies for educating students at-risk. Received from http://www2.ed.gov/pubs/EdReformStudies/EdReforms/index.html

Lester, F. K., Jr. (1994). Musings about mathematical problem solving research: 1970-1994. *Journal for Research in Mathematics Education* [Special Issue], *25*, 660-675.

Logsdon, Â. (n.d.). Learning Disability in Math Reasoning and Calculation. *Learning disability: What is a learning disability?* Retrieved from http://learningdisabilities.about.com/od/learningdisabilitybasics/p/Dyscalculia.htm

McDermott, P. A., Goldberg, M. M., Watkins, M. W., Stanley, J. L., & Glutting, J. J. (2006). A nationwide epidemiologic modeling study of LD: Risk, protection, and unintended impact. *Journal of Learning Disabilities*, *39*, 230-251.

Mellard, D. F., & Johnson, E. S. (2008). *RTI: A practitioner's guide to implementing response to intervention*. Thousand Oaks, CA: Corwin Press.

Mertler, C. A., & Vannatta, R. A. (2010). *Advanced and multivariate statistical methods: Practical application and interpretation* (4th ed.). Glendale, CA: Pyrczak.

Messick, S. (1989). Validity. In R. L. Linn (Ed.), *Educational Measurement* (3rd ed) (pp. 13-104). New York, NY: Macmillan.

Miller, S. P., Butler, F. M., & Lee, K. (1998). Validated practices for teaching mathematics to students with learning disabilities: A review of literature. *Focus on Exceptional Children, 31*(1), 1-24.

Milner, S. (1979). *Benefits of computer-based instruction*. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2231927/

Monk, D. (1994). Subject area preparation of secondary mathematics and science teachers and student achievement. *Economics of Education Review, 13*, 125-145.

Moody, E. (n.d.). *Educational alternatives to improving academic achievement in struggling students: Is computer-assisted instruction within an after-school tutoring program the solution?* Retrieved from teach.valdosta.edu/are/Vol6no1/PDF%20Articles/MoodyEArticle_ARE.pdf

Moors, A., & De Houwer, J. (2006). Problems with dividing the realm of cognitive processes. *Psychological Inquiry, 17*, 199-204.

Murphy, R., Penuel, W., Means, B., Korbak, C., & Whaley, A. (2001). *E-DESK: A review of recent evidence on the effectiveness of discrete educational software.* Menlo Park, CA: SRI International.

National Assessment of Educational Progress. (2003). *NAEP 2003 mathematical report card for the nation and the states.* Washington, DC: National Center for Educational Statistics.

National Center for Education Statistics. (2009a). *Internet access in U.S. public schools, school connectivity*. Retrieved from National Center for Education Statistics website: http://nces.ed.gov/pubs2002/internet/3.asp

National Center for Education Statistics. (2009b). *The nation's report card: Reading 2009* (NCES 2010-458). Washington, DC: United States Department of Education, Institute of Education Sciences.

National Center for Learning Disabilities. (2007). *What is RTI?* Retrieved from RTI Action Network website: http://www.rtinetwork.org/learn/what/whatisrti

National Center for Learning Disabilities. (2010). *What Is Dyscalculia?* Retrieved from National Center for Learning Disabilities website: http://www.ncld.org/ld-basics/ld-aamp-language/ld-aamp-math/what-is-dyscalculia

National Center on Educational Outcomes. (2010). *Accountability for assessment results in the No Child Left Behind Act: What it means for children with disabilities*. Retrieved from http://www. mn.edu/NCEO/Online Pubs/NCLBaccountability.html

National Center on Response to Intervention. (2010). *Essential components of RtI – A closer look at response to intervention*. Washington, DC: National Center on Response to Intervention.

National Center on Response to Intervention. (2011). *National Center on Response to Intervention (RtI)*. Retrieved from http://www.rti4success.org/index.php?option=com_content&task=view&id=448&Itemid=93

National Joint Committee on Learning Disabilities. (2005). *Responsiveness to intervention and learning disabilities*. Report prepared by the NJCLD representing 11 national and international organizations. Retrieved from www.ldonline.org/njcld

National Reading Panel Report. (2006). *Search NICHD Publications*. Retrieved from NICHD–The Eunice Kennedy Shriver National Institute of Child Health and Human Development website: http://www.nichd.nih.gov/publications/pubskey.cfm?from=reading

National Research Council. (2001). Adding it up: Helping children learn mathematics. In J. Kilpatrick, J. Swafford, & B. Findell (Eds.), *Mathematics Learning Study Committee, Center for Education, Division of Behavioral and Social Sciences and Education*. Washington, DC: National Academy Press.

Nave, J. (2007). *An assessment of READ 180 regarding its association with the academic achievement of at-risk students in Sevier County schools*. Unpublished doctoral dissertation, East Tennessee State University, Johnson City, TN.

No Child Left Behind (NCLB) Act of 2001. Pub. L. No. 107-110, § 115, Stat. 1425 (2002).

No Child Left Behind: What it means to you. (2002). Retrieved from Education World website: http://www.educationworld.com/a_issues/issues273.shtml

National Council of Teachers of Mathematics. (1991). *Professional standards for teaching mathematics.* Reston, VA. Retrieved from http://standards.nctm.org

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Retrieved from http://standards.nctm.org

National Council of Teachers of Mathematics. (2011). Standards Overview. *National Council of Teachers of Mathematics*. Retrieved from http://www.nctm.org/standards/content.aspx?id=26798

National Dissemination Center for Children with Disabilities. (2010). *Response to intervention (RTI)*. Retrieved from http://nichcy.org/schools-administrators/rti

No Child Left Behind: A toolkit for teachers. (2002). Retrieved from www2.ed.gov/teachers/nclbguide/toolkit_pg6.html

North Central Regional Educational Laboratory. (2004).*Technology and youth: Wired schools and wired lives.* Retrieved from www.ncrel.org/sdrs/areas/issues

North Central Regional Educational Laboratory. (2005). *Critical issue: Using technology to improve student achievement.* Retrieved from www.ncrel.org/sdrs/areas/issues/methods/technlgy/te800.htm

Obama, B. (2011). *President Obama calls on Congress to fix no child left behind before the start of the next school year* [White House Press Release]. Lecture conducted from White House, Washington, DC.

Ogonosky, A. (2011). *The response to intervention for secondary school administrators: How to implement RtI in middle and high schools* (3rd ed.). San Francisco, CA: Park Place Publication.

O'Sullivan, O., Brown, K., & Jones, L. (2004). *Effective teaching to raise boys' literacy learning and achievement.* Retrieved from Center for Literacy in Primary Education website: http://www.standards.dfes.gov.uk/ntrp/lib/pdf/OSullivan.pdf

Partnership for 21st Century Skills. (2004). *The Partnership for 21st Century* Retrieved from http://www.p21.org/

Partnership for 21st Century Skills. (2009). *Learning from the 21st century: A report and mile guide for 21st century skills*. Washington, DC: Partnership for 21st Century Skills.

Pearson. (2010). *Arkansas augmented benchmark examinations: Mathematics, literacy & science technical report for 2010* [Non-secured version]. Boston, MA: Pearson.

Pinnell, G. S., Pikulski, J. J., Wixson, K. K.; Campbell, J. R., Gough, P. B., & Beatty, A. S. (1995). *Listening to children read aloud*. Washington, D.C: United States Department of Education, Office of Educational Research and Improvement.

PLATO. (2001). *Middle school language arts.* Retrieved from http://www.plato.com/middle-school-language-arts

PLATO. (2008). *The next step in 21st century learning*. Retrieved from http://www.plato.com/Research-and-Resources.aspx

PLATO. (2010). *Professional services: Student achievement model.* Retrieved from www.plato.com/media/Brochures/3/PLATO%20Professional%20Services%20Student%20Achievement%20Model%20Brochure.pdf

PLATO. (2011). *PLATO learning introduces vcourses for launching effective virtual learning programs.* Retrieved from http://www.plato.com/company/news/press-releases/plato-learning-introduces-vcourses-launching-effective-virtual-learning-

PLATO. (n.d.). *Middle school math.* Retrieved from http://www.plato.com/middle-school-math

PLATO. (n.d.). *Our History*. Retrieved from http://www.PLATO.com/company/history

Prasse, D. P. (2002). Best practices; in school psychology and the law. In A. Thomas & J.Grimes (Eds.), *Best Practices in School Psychology IV*. Bethesda, MD: National Association of School Psychologists.

Questar. (2011). *2011 Arkansas augmented benchmark examinations for grades 3-8: Mathematics, literacy & science technical report* [Non-secured version]. Minneapolis, MN: Questar Assessment.

Rasinski, T. V. (2006). Reading fluency instruction: Moving beyond accuracy, automaticity, and prosody. *The Reading Teacher, 59,* 704-706.

Resnick, L. B. (1979). The future of IQ testing in education. *Intelligence, 3*(3), 241-253.

Response to Intervention. (2006). *Council of Administrators of Special Education*. Retrieved from www.casecec.org

Rice, J. K. (2003). *Teacher quality: Understanding the effectiveness of teacher attributes*. Washington, DC: Economic Policy Institute.

Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2001). *Teachers, schools, and academic achievement.* Amherst, MA: Amherst College.

Rivkin, S., Hanushek, E., & Kain, J. (2005). Teachers, schools, and academic achievement. *Econometrica, 73*(2), 417–458. Retrieved from http://edpro.stanford.edu/Hanushek/admin/pages/files/uploads/teachers.econometrica.pdf

Roblyer, M. D. (2004). *Integrating educational technology into teaching* (3rd ed.). Upper Saddle River, NJ: Merrill Prentice Hall.

Roschelle, J. M., Pea, R. D., Hoadley, C. M., Gordin, D. N., & Means, B. M. (2000). Changing how and what children learn in school with computer-based technologies. *The Future of Children*, *10*(2), 76-101.

Rose, D. (2004). *The role of technology in the guided reading classroom: Apprenticeships in reading and writing* [Scholastic Professional Paper]. Retrieved from http://teacher.scholastic.com/products/authors/pdfs/WW_GR_prof_paper.pdf

Ross, R. (2011). *Obama to overhaul No Child Left Behind and expand Race to the Top.* Retrieved from http://www.thepelicanpost.org

Routman, R. (2003). *Reading essentials: The specifics you need to teach reading well.* Portsmouth, NH: Heineman.

Ryan, A. (1991). Meta-analysis of achievement effects of microcomputer applications in elementary schools. *Educational Administration Quarterly, 27*(2), 161-184.

Salkind, N. J. (2008). *Statistics for people who (think they) hate statistics* (3rd ed.). London, England: SAGE Publications.

Sanders, W. L., & Horn, S. P. (1994). The Tennessee value-added assessment system (TVAAS): Mixed-model methodology in educational assessment. *Journal of Personnel Evaluation in Education, 8*(3), 299-311.

Sanders, W. L., & Rivers, J. C. (1996). *Cumulative and residual effects of teachers on future student academic achievement* [Research Progress Report]. Knoxville, TN: University of Tennessee Value-Added Research and Assessment Center.

Scanlon, D. M., Gelzheiser, L. M., Vellutino, F. R., Schatschneider, C., & Sweeney, J. M. (2008). Reducing the incidence of early reading difficulties: Professional development for classroom teachers vs. direct interventions for children. *Learning and Individual Differences, 18*, 346-359.

Scarborough, H. S. (2001). Connecting early language and literacy to later reading disabilities. In S. B. Neuman & D. K. Dickinson (Eds.), *Handbook of Early Literacy Research* (pp. 97-110). New York, NY: Guilford Press.

Schacter, J. (1999). *The impact of educational technology on student achievement: What the most current research has to say.* Santa Monica, CA: Milken Exchange on Educational Technology. Retrieved from ERIC database. (ED430537)

Scholastic. (2002). *An efficacy study of READ 180: A print and electronic adaptive intervention program grades 4 and above: Los Angeles Unified School District*. New York, NY: Author.

Scholastic. (2004a). *Scholastic's READ 180: A heritage of research*. New York, NY: Author.

Scholastic. (2004b). *Executive summary, DoDEA/Scholastic READ 180 Project: An evaluation of the* READ 180 *intervention program for struggling readers*. New York, NY: Author.

Scholastic. (n.d.). *Response to Intervention: An alignment guide for Read 189*. Retrieved from read180.scholastic.com/pdf/research/4_2007_ProfessionalPapers_ RTI%20Alignment_READ180.pdf

Scholastic READ 180. (2006). *Scholastic READ 180 next generation*. Retrieved from read180.scholastic.com/pdf/research/1_

Southwest Educational Development Laboratory (SEDL). (2007). Response to intervention (RtI): A systematic approach to reading and school improvement. *SEDL Letter, Reading: Practices to Help Improve Instruction, 19*(2). Retrieved from http://www.sedl.org/pubs/sedl-letter/v19n02/rti.html?vm=r

Shinn, M. (2008). Implementation in secondary schools. In S.Fernley, S. D. LaRue, & J. Norlin (Eds.). *What do I do when: Answer book on RTI.* (pp. 1–17). Arlington, VA: LRP Publications.

Sivan-Kachala, J., & Bialo, E. (2000). *2000 research report on the effectiveness of technology in schools* (7th ed.). Washington DC: Software Information Industry Association.

Slavin, R. (1988). Synthesis of research on grouping in elementary and secondary schools. *Educational Leadership*, *46*(1), 67-77.

Sornson, R., Frost, F., & Burns, M. (2005). Instructional support teams in Michigan: Data from Northville Public Schools. *Communique, 33*(5), 28–29.

Suen, H. K. (1990). *Principles of test theories.* Hillsdale, NJ: Lawrence Erlbaum.

Swigart, A. (2009). *Examining teacher's knowledge and perceptions of response to intervention*. (Unpublished master's thesis). Western Kentucky University, Bowling Green, KY.

Taylor, D. L. (2004). Not just boring stories: Reconsidering the gender gap for boys. *Journal of Adolescent & Adult Literacy, 48*(4), 290-298. Retrieved from http://www.accessmylibrary.com/coms2/summary_0286-11881334_ITM

Tell, T. (2010). PLATO: Case study of Conway public schools. Bloomington, MN: PLATO Learning.

Tienken, C., & Maher, J. (2005). *The influence of computer-assisted instruction on eighth-grade mathematics achievement.* Retrieved from http://www.kean.edu/~njncpea/documents/NCPEA08_CAI.pdf

Traynor, P. (2003). Effects of computer-assisted-instruction on different learners. *Journal of Instructional Psychology*, *6*, 22-24.

Trifiletti, J. J., Frith, G. H., & Armstrong, S. (1984). Microcomputers versus resource rooms for LD students: A preliminary investigation of the effects on math skills. *Learning Disability Quarterly, 7*, 69-76.

United States Office of Education. (1977). Assistance to states for education for handicapped children: Procedures for evaluating specific learning disabilities. *Federal Register, 42*. G1082-G1085.

United States Department of Education. (2006). *Highly qualified teachers for every child.* Retrieved from http://www.ed.gov/nclb/methods/teachers/stateplanfacts.html

United States Department of Education. (2007). *Achievement level file specifications.* Retrieved from http//ed.gov

United States Department of Education. (2008a). *Arkansas differentiated accountability proposal presented to the United States Department of Education*. Little Rock, AR: Arkansas Department of Education.

United States Department of Education. (2008b). *Response to intervention: A practitioner's guide to implementation.* Retrieved from www.cde.state.co.us/rti/downloads/PDF/RtIGuide.pdf

United States Department of Education. (2009). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies.* Retrieved from: http://www2.ed.gov/rschstat/eval/tech/evidence-based-practices/finalreport.pdf

United States Office of Special Education Programs. (2008). Ideas that Work. Retrieved from United States Office of Special Education Programs website: https://www.osep-meeting.org/2008conf/presentations/2dUnited States Department of Education. (2010). *A blueprint for reform the reauthorization of the elementary and secondary education act*. Washington, DC:

VanDerHeyden, A. M., & Witt, J. C. (2005). Quantifying context in assessment: Capturing the effect of base rates on teacher referral and a problem-solving model of identification. *School Psychology Review, 34*, 161-183.

VanLehn, K. (1996). Cognitive skill acquisition. *Annual Review of Psychology, 47*, 513-539. Retrieved from http://www.questia.com/googleScholar.qst?docId=5000322021

Vaughn, S., Gersten, R., & Chard, D. J. (2000). The underlying message in LD intervention research: Findings from research syntheses. *Exceptional Children, 67*(1), 99–114.

Vaughn, S., & Linan-Thompson, S. (2006). Special education for students with learning disabilities: What makes it so special? In B. Cook and B. Schirmer (Eds.), *What is special about special education? Examining the role of evidence-based practices* (pp. 1-11). Austin, TX: PRO-ED.

Wayne, A., & Youngs, P. (2003). Teacher characteristics and student achievement gains: A review. *Review of Educational Research, 73*(1), 89-122.

Wenning, R., Herdman, P. A., Smith, N., McMahon, N., & Washington, K. (2000). *No Child Left Behind: Testing, reporting, and accountability* [ERIC Digest]. Retrieved from http://www.ericdigests.org/2004-2/behind.htmlED480994

Wheeler, C. (2010). *Evaluating the reliability of selected school-based indices of adequate reading*. (Unpublished doctoral dissertation). University of Oregon. Retrieved from http://proquest.umi.com/pqdlink?Ver=1&Exp=11-18-2016&FMT=7&DID=2132214701&RQT=309&attempt=1

Williams, J. (2006). *When your child needs extra help: What you should know.* Retrieved from the Education & Child Development Site for Parents website: http://www.education.com/magazine/article/RTI-pro-con/

Willingham, W. W., & Cole, N. S. (1997). *Gender and fair assessment*. Mahwah, NJ: Lawrence Erlbaum Associates.

Wilson, L. (2008). *Response to intervention: Making it work in your school*. Lecture conducted from Arkansas Department of Education. Little Rock, AR.

Wong, B. Y., Wong, R., Perry, N., & Sawatsky, D. (1986). The efficacy of a self-questioning summarization strategy for use by underachievers and learning disabled adolescents in social studies. *Learning Disabilities Focus, 2*(2), 20-35.

Woods, D. E. (2007). *An investigation of the effects of a middle school reading intervention on school dropout rates* (Unpublished doctoral dissertation), Virginia Polytechnic Institute and State University, Blacksburg, VA.

Wright, J. (2011). *How RtI works*. Retrieved from www.interventioncentral.org/sites/default

Wright, P. W., & Wright, P. D. (2007). *Wrightslaw: Special education law* (2nd ed.). Hartfield, VA: Harbor House Law Press.

Wright, S. P., Horn, S. P., & Sanders, W. L. (1997). Teacher and classroom context effects on student achievement: Implications for teacher evaluation. *Journal of Personnel Evaluation in Education, 11*, 57-67.

Yell, M. L., Drasgow, E., Lowrey, K. A. (2005). No Child Left Behind and Students with Autism Spectrum Disorders. *Focus on Autism and Other Developmental Disabilities*, *20*(3), 130-139.

Yell, M. L., Katsiyannas, A., Shiner, J. G. (2006). The No Child Left Behind Act, adequate yearly progress and students with disabilities. *Teaching Exceptional Children, 38*(4), 32-39.

APPENDIX

APPENDIX A

HARDING
UNIVERSITY
INSTITUTIONAL REVIEW BOARD

Status of Request for Exemption from IRB Review

(For Board Use Only)

Date: 2-7-2012

Proposal Number: 2012 - 009

Title of Project: Effects of Computer Assisted Tier II Interventions by Gender on Math and Reading Achievement for Remediated Students

Name and Contact information for the Principal Investigator: Kathi Sweere; sweerek@conwayschools.net

- [x] 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 [x] 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