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21st century assessment : an examination of the relationship among computer-adaptive homework, self-regulation strategies and student scores on computer-adaptive assessment

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ABSTRACT

21st CENTURY ASSESSMENT: AN EXAMINATION OF THE RELATIONSHIP AMONG COMPUTER-ADAPTIVE HOMEWORK, SELF-REGULATION STRATEGIES AND STUDENT SCORES ON COMPUTER-ADAPTIVE ASSESSMENT

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This study investigated the relationship between fifth grade students' computer-adaptive assessment performance (TAP) scores when a computer-adaptive eLearning platform was assigned for homework along with a self-regulated learning (SRL) treatment intervention. The adaptive learning theoretical model and the TAP conceptual framework supported the rationale for the utilization of the digital computer-adaptive systems of learning and assessing. In addition, the study m m examined the predictive ability of the Measures Strategy Learning Questionnaire (MSLQ) a self-reporting survey on MAP assessment performance scores. The theory of SRL provided the foundation for the strategies implemented in this study.

The participants consisted of three fifth-grade classes split across two elementary schools within a single school district in the Southwest suburbs of Chicago. One school housed 41 of the participants in two classrooms. In Class One, there was a total of 19 participants, and Class Two consisted of a total of 22 participants. These students were assigned the computer-adaptive English Language Arts (ELA) homework, while the control group of 17 participants attended the second school and were assigned traditional homework (e.g., pencil and paper assignments).

Random assignment of the participants was not possible since the fourth grade teachers had equally distributed the students by race, gender, academic ability, and behavior at the end of previous 2014 – 2105 school year. The three classes were comparable in terms of participants' gender, racial/ethnic identity, and socioeconomic status. In lieu of assigning students to classes, conditions were assigned to the three participating classes. In total, 58 students participated in this study.

The findings of this study showed the scores on the Measures of Academic Progress assessment (MAP) increased significantly from pretest to posttest across all conditions. There were no statistical significant differences in posttest MAP composite scores based on the treatment conditions. The students who participated in computer-adaptive homework with a self-regulated learning strategy treatment intervention did not perform significantly better on the MAP than students using computer-adaptive homework only. Equally, students who used computer-adaptive homework did not perform significantly better than students in the control group. Finally, scores on the MSLQ did not predict students' performance on the posttest MAP composite score. Although the findings of the current study lacked statistical significance, the findings provided additional research in the areas of computer-adaptive platforms used for homework assignments, the implementation of self-regulated learning strategies, and the impact on computer-adaptive assessment.

Considering the recent advancements in educational technology and implementation of the new generation of digital assessments, the findings support additional research needs to be done to identify the specific ways in which computer-adaptive eLearning platforms can support student performance and academic success on the new digital assessments.

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To Mom and Dad- Although you were not able to be here to share this accomplishment with me, I want you to know that I worked hard, tried my best, and have no regrets. My life is full.

To My Daughters – Kristi Hope and Kayla Brooke – Keep yourselves educated and NEVER stop learning.

To My Grandchildren – Jackson, Annalyse, Elliana, Cambria, and Elizabeth – Always strive to be Life Long Learners. Work hard, try your best, and have **no** regrets.

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CHAPTER 1

INTRODUCTION

For over a decade, research has provided evidence of the utility and popularity of computer-based assessment ([CBA]; Dillion, 1992; Gardner & Davis, 2013). CBAs utilize algorithms such as simulations, online experiments, and graphing to measure one's learning. Multiple institutions, including the United States military, colleges and universities, state driver's license facilities, and many for-profit organizations, have adopted CBAs to measure test-takers' performance. Yet school districts have been slow to adopt CBAs as a primary assessment format, and until recently, in most K-12 grade levels, CBAs have been an optional assessment format (Clariana & Wallace, 2002; Gardner & Davis, 2013; McDonald, 2002; Thompson, 2014). However, societal and contextual changes that have led to wide-scale demand for greater teacher accountability, increased reliance on standardized testing (Ravitch, 2013), and adoption of the rigorous Common Core State Standards (CCSS) and digital assessment systems have generated the need for more efficient and rigorous assessment methods and acceptance of CBA within K-12 classrooms.

Recently, following the national trend, the state of Illinois restructured the measurement standards for teacher and principal performance, thereby making student achievement an issue of critical importance. For example, the Performance Evaluation Reform Act (PERA), passed in 2010, required that performance evaluations of teachers and principals include ratings of professional skills as well as measures of student achievement and growth (ISBE, 2015c). In addition to the new teacher performance standards, the state adopted the CCSS, which developed the scope and sequence for student proficiency at each grade level. Following this mandate was the integration and implementation of a digital standardized CBA in K-12 classrooms (Herman & Linn, 2013; Kolbe & King-Rice, 2012; McGuinn, 2012; Onosko, 2012; Tamayo, 2010). The dramatic shift in teacher accountability, implementation of more stringent teaching and assessment standards, and integration of CBAs into classrooms have serious implications for student achievement (Daggett, Gendron, & Heller, 2010). Most notably, these changes have forced the K-12 grade levels into the 21st century assessment and accountability movement (Tamayo). Consequently, these changes in educational policy have increased teachers' responsibility for student achievement gains and fostered a sense of urgency to either adapt existing methods or develop new methods to help students make gains in their academic performance scores.

One such existing method is the role that homework plays in student achievement. Homework by definition is any assigned learning task that is to be completed after the school day ends (Cooper, 2007). Previous empirical investigations have discussed the importance of homework (Cooper & Valentine 2001; Trautwein, 2007; Trautwein, Koller, Schmitz, & Baumert, 2002) and reported a significant positive relationship between homework and academic performance in K-12 grade levels (Ronning, 2011). Further, homework, historically, has been an acceptable way for students to practice skills learned inside the classroom without classroom constraints (Pelletier & Normore, 2007).

There are numerous variations in assigned homework – including amount, format, and purpose – that may influence whether students complete their assignments (Pelletier & Normore, 2007). Further, successful homework completion requires learners to be self-regulated or possess the ability to monitor and adjust their behavior (Bembenutty, 2011). Self-regulation and self-regulated learning (SRL) refer to the extent to which students are “metacognitively, motivationally, and behaviorally active participants in their own learning process” (Zimmerman, 2008, p. 167). The variations in both homework characteristics and students’ use of SRL influence students’ homework-related behaviors. Cooper, Lindsay, Nye, and Greathouse (1998) reported students who take responsibility for their own learning and regulate their homework behaviors have a better chance of experiencing successful homework completion, and as a result, greater homework completion rates should increase student achievement.

Another consideration is the congruency between concept practice and assessment format. Previous research has shown that students can achieve significant gains in academic performance when the homework assignment format (e.g., paper and pencil) mimics the assessment format (e.g., paper and pencil) (McDonald, 2002). Thus, an instructional format similar to the homework format may help to reinforce the concepts learned in the classroom, which in turn carries over to a similar assessment format. Thus, McDonald’s conclusion was positive effects of homework on students’ achievement were, in part, the result of the congruence between the homework and the testing format.

However, the recent transformation of assessments from more traditional formats (e.g., paper and pencil) to CBA may impact student academic performance, since most homework formats have remained unchanged. Consequently, if the traditional homework format does not match the recent changes in assessment format, as evidenced in K-12 classrooms, disconnect may occur between concept transfer and academic achievement.

Furthermore, as education seeks ways to transition from traditional pencil and paper formats to CBAs, advances in educational technology, especially computer-adaptive learning platforms, may provide an effective solution. Computer-adaptive learning platforms are a type of assistance or intelligent tutoring system that provides remedial homework that prioritizes problems, assesses student responses, and generates immediate feedback (Lee & Heyworth, 1997; Leong, 2013; Mendicino, Razzaq, & Heffernan, 2009). Computer-adaptive tutoring systems can guide and respond to students' individual learning needs. Many of these tutoring systems are programmed to imitate a human tutor via interactive features that deliver content through dialogue patterns as well as immediate and corrective feedback on students' submissions (Mendicino, et al.). According to McDonald (2002), computer-adaptive homework is capable of assessing academic skills that are not easily measured by traditional means (e.g., pencil and paper assessments). Therefore, the use of computer-adaptive homework may provide students with a tool that supports the transfer of classroom learning without compromising student performance on computer-based assessments.

In summary, previous studies have found that many existing methods, such as traditional homework methods, have played a positive role in student achievement and contribute to increased student achievement scores (Cooper & Valentine 2001; Trautwein, et al., 2002; Trautwein, 2007), while SRL influenced homework completion and congruency between the practice and assessment formats have resulted in an increase in student achievement and performance scores (Bembenutty, 2011; Cooper, et al., 1998; Pelletier & Normore, 2007; Zimmerman, 2008). Although these traditional variables have had a positive effect on student achievement when combined, this study sought to determine whether these factors exhibited a positive effect on student academic achievement utilizing a digital homework learning platform and a digital assessment system.

This study examined elementary students' use of Scootpad®, a computer-adaptive homework learning platform, and its effect on student performance outcomes via the Measures of Academic Progress (MAP), a computer-adaptive assessment system. It also investigated SRL, both with and without a treatment intervention the effects of the computer-adaptive learning homework platform assignments and student achievement MAP scores.

Conceptual Framework

The conceptual framework for this study included the adaptive learning theoretical model (Pressey, 1926; Skinner, 1950), the transfer-appropriate processing framework (Blaxton 1989; McCrudden, 2011; Morris, Bransford, & Franks, 1977), and the theory of self-regulation and self-regulated learning (Schunk 1994, 1996; Zimmerman, 2008) to investigate student use of Scootpad®, a computer-adaptive learning platform, and the effect on Measures of Academic Progress, a computer-adaptive assessment system. A brief outline of each is provided here, while a detailed analysis of each framework will be discussed in greater detail in Chapter 2.

Adaptive Learning Theory

The extant literature has shown that adapting instruction to an individual student's learning style results in better learning outcomes (Murry & Perez, 2015). Adaptive learning theory (Pressey, 1926; Skinner, 1958, 1961) incorporates the fields of information technologies and electronic learning (eLearning) to provide personalized education for each student (Kostolanyova & Sarmanova, 2014). As the student moves through graded content, the computer adjusts future questions based on the past responses of the learner (Kostolanyova &

Sarmanova). This process allows the learner to obtain personalized prompts for academic advancement in his/her learning.

Computer-adaptive eLearning platforms provide each student with unlimited practice attempts to customize the content level of learning for the student. This modification reinforces, develops, and advances the student's level of understanding. Therefore, the computer-adaptive opportunity allows the student to learn at his/her own pace.

Transfer-Appropriate Processing Framework

Transfer-appropriate processing (TAP) posits that students are better able to transfer learned concepts to assessments when the formats for practice and assessment are similar (Morris et al., 1977). Blaxton (1989) found that students are more likely to answer a test question correctly if the physical features of the test format are similar to the instruction and practice features. Further, congruence between the homework format and the assessment format contributed to the transfer of learning (McCrudden, 2011). Therefore, for homework to be effective, it not only needs to provide practice of the concept, but the format must be congruent with the assessment format (McCrudden), which is the basis of this study.

The change from the traditional assessment format (e.g., paper and pencil) to CBA provides a rationale for examining how the format of assigned homework influences performance results. As a result, this study posited that congruency between computer-adaptive homework and CBA formats would allow fifth grade students to transfer content knowledge without a compromise in their academic performance scores.

Self-Regulation Framework

There are many theories that have tried to explain why certain students are more academically successful than others. The most basic groups of learners can be classified as either active or passive; that is, motivational differences allow the students to act or react to a variety of internal or external factors (Ryan & Deci, 2000). In brief, self-regulation is the cognitive area concerned with the students' ability to self-regulate their learning, while the motivational area hones in on the ways students stay motivated to learn. Chung and Yuen (2011) have noted, "A large body of empirical evidence suggests that self-regulated learners are more effective, confident, resourceful, and persistent in learning" (p. 22). Self-regulated behavior is an area that focuses on monitoring and controlling the learners' behaviors, while context includes the ways students make their environment conducive for learning (Anthony, Clayton, & Zusho 2013).

Whereas Zimmerman (2008) defined self-regulated learning (SRL) as "self-regulation of learning [that] involves more than detailed knowledge of a skill; it involves the self-awareness, self-motivation, and behavioral skill to implement that knowledge appropriately" (p. 167), SRL refers to students' abilities to use SRL strategies to help direct their motivation toward their actions such as setting goals or monitoring their learning (Gonzalez, 2013; Kitsantas, Steen, & Huie, 2009). The students' self-regulation and SRL can be measured utilizing the Motivated Strategies for Learning Questionnaire (MSLQ). The MSLQ assesses both motivational and cognitive beliefs and skills that underlie effective regulation of learning (Anthony et al., 2013). This instrument paralleled the current study well, in that self-regulation and SRL strategies are key factors that are under investigation. The MSLQ will be discussed in further detail in Chapter 3.

Today's students are bombarded with choices as to how they spend their non-school hours, some of which support and others that conflict with their learning goals; consequently, the choices students make will affect their academic performance (Xu, 2013). As stated earlier, successful homework completion requires students to utilize SRL strategies (Bembenutty, 2011), and as a result, there are numerous benefits to student acquisition and utilization of SRL strategies. In addition, previous research supports the notion that students who possess characteristics associated with SRL have been shown to score higher on performance assessments compared to those without SRL-related characteristics (Kitsantas & Zimmerman, 2009). Consequently, research (Bembennutty, 2011; Gonzalez, 2013; Schunk, 1994, 1996) has suggested that SRL strategies play an essential role in helping students complete their assignments outside of the classroom.

Merging of Theories

The three theories grounding this study (adaptive learning theory, self-regulation theory and transfer-appropriate processing [TAP]) are very distinct. Adaptive learning theory is tied specifically to the computer system that adjusts to meet the individual learning needs of each student (Shapiro & Gebhardt, 2012; Wang et al., 2013), whereas self-regulation is the human aspect that links students' thought processes, strategies, and learning behaviors to attain learning goals (Patterson, 2008). TAP posits that if the assessment is congruent to the way in which the learner practiced the concept, then the transfer of student knowledge may not be compromised (McCrudden, 2010).

This study examined a computer-adaptive homework learning platform and the effects it had on students' performance on computer-adaptive assessments. The adaptive learning theoretical model and the TAP conceptual framework support utilization of digital computer-adaptive systems of learning and assessing, while the theory of SRL provides a foundation for strategies to help students regulate their learning. This examination can add to current literature by providing an additional resource that connects traditional teaching and learning methods to the new generation of digital assessment formats.

Problem Statement

Over the past several decades, a multitude of changes that impact teaching and learning expectations in the classroom have been incorporated into national educational policy in the United States. These policies have changed the methods as well as the curriculum utilized in the classroom, including how both students and educators are evaluated.

The release of *A Nation at Risk* in 1983 was a driving force in shaping and reforming standardized-testing. This report suggested that public schools were failing to prepare students for the workplace and the global economy (National Commission of Excellence in Education [NCEE], 1983). Another educational reform act, No Child Left-Behind (NCLB), required all 50 states to create and implement standardized tests in reading and mathematics and to increase teacher accountability (U.S. Department of Education, 2008). The most recent educational reform occurred in 2009 in the wake of an economic recession, in which the program Race-To-The-Top offered $4.35 billion in discretionary grant funds to states that agreed to several mandates (i.e., the adoption of the CCSS and performance-based teacher pay incentives for student growth components). These policy mandates raised the national standards of achievement and increased teacher accountability (Hunter 2010; Smarick, 2010).

Subsequently, recent federal and state mandates along with advancements in technology have helped raise the standards of achievement in the United States and created an innovative assessment system that has transformed the way schools report yearly academic growth (Dagget et al., 2010). For generations, elementary students were taught to complete daily class assignments and homework using the traditional pencil and paper method. Students were then assessed using the same paper and pencil method on examinations (Thompson, 2014). The format of the daily assignments, homework, and assessments was parallel, meaning the students' understanding was supported and knowledge was transferred due to the similarities in the testing format (Blaxton, 1989; McCrudden, 2011; Morris et al., 1977). This traditional way of teaching continues to be a popular educational approach in many classrooms throughout the United States (Thompson); however, policy mandates for increased teacher accountability and the adoption of the CCSS have altered the way K-12 students are assessed. Transformation from the pencil and fill-in-the bubble-test booklet to computer-based testing systems requires students to now drag, drop, and type their responses to questions. Such changes may have created disconnect between how students are taught and how students are assessed (Blaxton; McCrudden; Morris et al.).

In sum, the digitally formatted high-stakes assessments have caused educators to reevaluate traditional teaching methods and learning support strategies. An investigation into the mode of learning coupled with the same mode of assessment may provide instructional insights for educators. The current study examined the use and effect a computer-adaptive homework learning platform had on student scores on computer-adaptive assessments.

Purpose Statement and Research Questions

The purpose of this study was two-fold. First, it examined fifth grade students' use of a computer-adaptive homework learning platform and its effect on student performance on a computer-adaptive assessment. Second, it investigated the relationship between self-regulation and SRL strategies and students' scores on a computer-adaptive assessment. The following research questions guided the study:

1. Do students who use a computer-adaptive homework platform with a self-regulated learning strategy treatment intervention perform better on the Measures of Academic Progress than students not using any computer-adaptive homework or students using only computer-adaptive homework?

   H1. Students who participate in a computer-adaptive homework learning platform with a self-regulated learning strategy treatment intervention will perform better on the Measures of Academic Progress than students not using computer-adaptive homework learning platform or students using only computer-adaptive homework.

2. Do students who use a computer-adaptive homework learning platform only perform better on the Measures of Academic Progress than students not using any computer-adaptive homework learning platform?

   H2. Students who participate in computer-adaptive homework learning platform only will perform better on the Measures of Academic Progress than the control group who did not receive the computer-adaptive homework learning platform or the learning strategy treatment intervention.

3. Do student's scores on the Motivated Strategies for Learning Questionnaire predict achievement scores for the Measures of Academic Progress, a computer-adaptive assessment?

H3. Student scores on the Motivated Strategies for Learning Questionnaire will predict achievement scores on the Measures of Academic Progress.

Table 1.1 presents each research question and the unit of assessment used to collect the data from each group.

Table 1.1

Research Questions and Unit of Data Collection for Each Group

Research Questions	**Computer-Adaptive Homework and Self-Regulated Strategies Group**	**Computer-Adaptive Homework Group**	**Control Group**
1. Do students who use a computer-adaptive homework learning platform with a self-regulated learning strategy treatment intervention perform better on the Measures of Academic Progress than students not using any computer-adaptive homework learning platform or students using only computer-adaptive homework?	**MAP**	**MAP**	**MAP**
2. Do students who use a computer-adaptive homework learning platform only perform better on the Measures of Academic Progress than students not using any computer-adaptive homework?	**MAP**	**MAP**	**MAP**
3. Do students' scores on the Motivated Strategies for Learning Questionnaire predict achievement scores on the Measures of Academic Progress?	**MAP** **MSLQ**	**MAP** **MSLQ**	**MAP** **MSLQ**

Significance of the Study

Previous studies have examined the congruence between traditional learning formats and traditional testing formats as well as the congruence between traditional learning formats and computer-based assessment (Blaxton, 1989; McCrudden, 2011; Morris et. al, 1977). However, research conducted on format congruency between computer-adaptive homework and computer-adaptive assessment is limited (Lee & Heyworth, 1997; Leong, 2013; Mendicino, et al., 2009). This study examined the use of a computer-adaptive homework eLearning platform and its effect on computer-adaptive assessments.

However, many questions remain about how technology formats affect learning and student achievement. This study may provide educators with insight about the effects of format congruency, or lack of congruency, between homework formats and computer-adaptive assessments. Furthermore, as K-12 public education shifts from traditional assessments to computer-generated assessments, this study may offer the classroom teacher a widely accepted research-based method that has been proven to have a positive effect on student understanding and academic performance, which in turn will help both the students and teachers transition into the new generation of assessments.

Computer-adaptive technology offers students an individualized learning plan, which can in turn impact learning outcomes. Therefore, the format of computer-adaptive homework eLearning platforms may assist, or even enhance, students' ability to complete computer-adaptive assessment without compromising their performance scores because transfer-appropriate processing skills may be developed as a result of the congruency. Additionally, this study may provide a meaningful contribution to the extant literature of elementary students' computer-adaptive assessment and the resources available through technological eLearning platforms.

Definition of Terms

The following terms provide the reader with background knowledge regarding this study.

Adaptive systems adjust to suit particular learner characteristics and needs (Shute & Zapata-Rivera, 2007).

Adaptive technologies help achievement of goals and are typically controlled by the computational devices, adapting content for different learners' needs and sometimes preferences. Information is usually maintained within a learner model (LM), which is a representation of the learner managed by an adaptive system. LMs provide the basis for deciding how to provide personalized content to a particular individual and may include cognitive as well as non-cognitive information. LMs have been used in many areas, such as adaptive educational and training systems (e.g., intelligent tutoring systems), help systems, and recommender systems (Shute & Zapata-Rivera, 2007).

Computer-adaptive assessment is a real time method of test administration that adjusts an assessment's level of difficulty based on individual students' responses (Tamayo, 2010).

eLearning is short for electronic learning, that is instruction delivered via computer technology with a wide spectrum of technologies that are mainly internet or computer-based learning (Karmakar & Nath, 2014).

Methodology

A nonrandomized pretest-posttest quasi-experimental design was used to examine the assessment outcomes of students not using computer-adaptive homework, students using only computer-adaptive homework, and students using computer-adaptive homework learning platform and a learning strategy treatment intervention. In addition, this study investigated whether a relationship exists among the variables (Gravetter & Wallnau, 2014; Merriam 2009). A self-regulation survey utilizing Likert-type items provided a snapshot of the students' attitudes and opinions regarding their cognition, motivation, and behavior during the learning process as well as the context in which the learning occurred (Patten, 2011). A detailed explanation of the methodology will follow in Chapter 3.

Delimitations

This study was limited to three intermediate level fifth grade classes in one K-12 school district. The study occurred in only two of the 12 elementary schools within the district. One school contained two classes; these classes were chosen because it is the only elementary school to provide funding for building-wide access to the computer-adaptive homework program. The second school was chosen because of it similarities to the first school in demographics, socioeconomic status, classroom structure, and assessment scores.

Limitations

There are several factors that limited the ability to generalize the results of this study. First, only one computer-adaptive program, Scootpad®, was studied; thus, the results may be unique to this population of students using this particular software. Second, the study was implemented during the first semester of the school year. It is possible that a longer study duration could yield different results due to the increased exposure to the computer-adaptive homework platform. Further, fifth grade students experience a unique maturation period during the second semester, and this could influence scores between the first and second semesters.

Finally, the internal validity of this study may be weakened because of the different teaching styles and teacher experience across the classes.

Organization of Study

This study is organized into five chapters. The first chapter provides a foundation for the importance of the study. It includes the problem and purpose of the study as well as an overview of the framework used to complete the study. The second chapter contains a review of the literature related to the problem and conceptual framework for the study. The third chapter presents the methods used to complete the study. The fourth chapter presents the data collected to answer the research questions. Finally, the fifth chapter discusses the findings and provides conclusions, implications, and suggestions for future research.

CHAPTER 2

REVIEW OF LITERATURE

In the spring of 2014, many classrooms across fourteen states and the District of Columbia that had adopted the Common Core State Standards (CCSS) participated in the new generation of digital assessments utilizing the Partnership for Assessment of Readiness for College and Career ([PARCC], PARCCINC, 2015). This population represented more than one million students in 16,000 schools. The field test allowed both educators and students to “test the test.” These new assessments were administered digitally, and although the field test did not generate student-level scores, it allowed the participating schools to gain familiarity with the testing process, the quality of the test questions, and evaluate computer-based delivery online platform (PARCCINC.). The feedback from the field test was used to make adjustments to future testing sessions.

In the spring of 2015, over 5 million students in grades 3-11 in 11 states, including Illinois, and the District of Columbia took the annual PARCC assessments. This time, student scores were calculated and released (PARCCINC, 2015). The preliminary results of the student scores showed a significant drop in both English Language Arts (ELA) and mathematics scores, which equated to only a 31 percent pass rate (ISBE, 2015c). Although the implications of technology-generated assessments have not been fully examined, educators have begun to evaluate and address the possible causes for the dramatic decrease in the results.

One reason may be the result of the transition from the previous standards and traditional assessment format (e.g., pencil and paper test booklet) to the more rigorous CCSS and the technology-generated assessment format (Luther, 2015). The initial implementation, along with the first couple of years utilizing both the new digital format and the more stringent standards, have educators anticipating the decrease in student performance scores. And although these lower performance scores may be a change in the more stringent assessments, it may be perceived by stakeholders as a failure by educators to meet the needs of the students (NWEA, 2013b). As a result, these lower scores have caused administrators and educators to search for ways to show the students' steady learning growth during this transition to the next generation assessments (Dagget et al., 2010). The computer-adaptive assessment Measures of Academic Progress complements the PARCC summative assessment scores by providing consistent, accurate, and instructionally relevant student learning growth over-time data (NWEA). That is, by utilizing this type of student growth data, teachers can show stakeholders a broader picture of the students' achievement when compared to the PARCC assessments

This study investigated the use of a digital eLearning platform, Scootpad®, for reading homework and examined the possible implications it may have on student performance when utilizing a technology-generated assessment, Measures of Academic Progress (MAP).

At the time of this study no empirical studies emphasizing the impact of CCSS and digital assessment performance results were found; however, several anecdotal reports had been written, and the conclusions were mixed. One report by the developers of the new assessment revealed that the PARCC field test in Spring 2014 showed "the field test went well and was a largely positive experience" (PARCC, 2015, p. 2). An article in the *Washington Post* reiterated the developers' findings; Layton (2014) wrote that "one million students in 14 states tested new

Common Core standardized exams this spring, and the experiment went well" (p. 1). However, other findings by Olgetree, Olgetree, and Allen (2014) reported that "the transition was fraught with many challenges for students with limited experience for online test taking" (p. 184). The authors noted that the first online testing results were negatively skewed and the testing for inexperienced or students lacking experience with online testing platforms created poor results.

The CCSS and technology-generated assessment formats are more concise and more rigorous than the previous state standards, and they range beyond the usual multiple-choice and short-answer questions (Daggett et al., 2010; NWEA, 2015). The implementation of the next generation of technology-based summative assessments for ELA and mathematics has begun, and the consequences of these assessments are significant to both students and educators (Herman & Linn 2013). Therefore, this literature review presents policy changes and mandates that have accompanied the new digital assessments, including the technological advancements that have supported the more rigorous CCSS and the digital assessment format. The topics of both traditional and digital homework are reviewed as well as the underlying conceptual frameworks and theories and teaching models and strategies that provide support for this study.

History of Educational Policy

Over the past several decades the United States has experienced a multitude of changes and dramatic transformations in the policies and ideologies in the educational system. Previous education reform initiatives (e.g., A Nation at Risk, No Child Left Behind) sought to increase student performance as well as teacher accountability for student achievement, which altered teaching and learning expectations in the classroom (Dahlin & Tarasawa, 2013; National Commission on Excellence in Education, 1983; Tyack & Cuban, 1995). These policies changed the teaching methods and curricula used in the classroom and altered how both students and educators are evaluated.

Many studies have been conducted to analyze and report the quality of the American educational institution. Therefore, factors that have impacted the implementation of the recently introduced educational assessment innovations are reviewed in this chapter. The findings provide the reader insight into and increased understanding of the mandates and advancements that contributed to development of the newly introduced educational assessment innovations.

A Nation at Risk

The *A Nation at Risk* policy statement was one of the most influential for educational reform and improvement. This report examined the quality of public education in the United States and questioned the inconsistencies that were inherent throughout the American educational system (National Commission on Excellence in Education, 1983). In 1981, the National Commission on Excellence in Education (NCEE) investigated the quality of teaching in the private and public schools to better understand which programs resulted in student success as well as to assess social and educational changes that affect student achievement. The final report highlighted the United States' poor academic achievement in comparison to other advanced nations and defined specific problems that must be overcome to achieve educational excellence (NCEE, 1983).

The major development yielded from the NCEE's (1983) report was the identification of student expectations, time on classroom instruction, and teaching instruction strategies as the primary deficiencies in the educational system. Confirmation of the notion that the American school system was failing its children provided another opportunity to reform the American education institution. It was believed that by returning to excellence in education, our nation would find its way back to world leader status (NCEE).

No Child Left Behind

The No Child Left Behind (NCLB) Act of 2001 was yet another push for reform in educational policy. This policy was unique as it required schools to show gains in student performance – not just overall increases in student learning but growth in subgroups. The subgroups were segmented based on ethnicity, gender and students with special needs. Under this type of reform, schools were expected to generate continual improvement in student achievement, with the goal of maintaining 100% proficiency in mathematics, reading, writing and science by 2014. The penalties for a school not meeting adequate yearly progress (AYP) were severe and could result in staff reductions and loss of funding from the federal and state government. In order for a school to accurately analyze and report its growth, a student rating system had to be created, and states were required to establish standardized tests in science, mathematics, reading, and language arts for all students from kindergarten to 12th grade (Gall & Acheson, 2011). The outcome of the assessments was to determine whether a child was attaining the projected growth each year. Unfortunately, the inconsistencies among each state's standardized testing made it difficult to accurately compare inter-state data, which led to the failure of NCLB to effectively create substantial and positive educational reform (Hunter, 2010; Smarick, 2010).

In 2008 a report by the United States Department of Education found that although NCLB required all 50 states to have annual standardized tests in reading and mathematics with all results available to the general public via the internet, little information on teacher effectiveness had increased during the same period, which highlighted the importance of increased accountability in schools. The Act did not assert a national achievement standard, and each individual state developed its own standards. However, the Act did expand the federal role in public education through an emphasis on annual testing, annual academic progress, report cards, and teacher qualifications as well as significant changes in funding. And as a result of this educational reform, educational leaders' discourse was focused on the topic of the roles teachers play in the preparation of students for college and career paths and on the role of standardized testing in the 21st century (Hunter, 2010; Smarick, 2010).

Race to the Top

A movement by the Obama Administration to override the NCLB law, "which mandated that all students must be proficient in math and reading by the year 2014," provided waivers to opt out of NCLB (McFarland, 2013, p. 1). The waiver was granted to states that promised to improve each year and to focus on teacher effectiveness in the classroom (McFarland). The educational reform approach was connected to the grant program that utilized grant funding as an incentive for schools to make improvements in teaching methodologies and student performance.

In 2009, the American Recovery and Reinvestment Act provided nearly $100 billion in nonrecurring federal funds for education (U.S. Department of Education, 2009) through an initiative known as the Race to the Top Fund (RTT). This provision's main purpose was to stabilize the state and local education budgets due to disruptions caused by the economic recession (Kolbe & King Rice, 2012; Koppich & Esch, 2011; McGuinn, 2012).

The program's large one-time grant resulted in individual states competing against one another to obtain the funding (U.S. Department of Education, 2009). Nearly all of the states (47) applied for the RTT funding in the first, second, or both of the qualifying rounds (U.S.

Department of Education). It was during this time that educational policy shifted from a state-centered approach to a federally-governed approach (Koppich & Esch, 2011; McGuinn, 2012). RTT's funding transformed the role state government occupied in education and empowered the federal government to create a national curriculum; thus, RTT significantly impacted educational policy in just a short amount of time (McGuinn).

While the grant was able to fund billions of dollars for educational use, states were required to evaluate teacher performance to include how well students performed on standardized tests (Gall & Acheson, 2011). However, to accurately compare states' performance and improvement, it was determined that common standards must be utilized to evaluate the end results. Policy makers believed that accountability would be easier to establish if all educators enforced student learning through a shared curriculum between the states. This conceptualization of education led to the inception of the Common Core State Standards.

Performance Evaluation Reform Act

In an attempt to address teacher accountability, educational leaders began to more closely measure and examine the level of effectiveness of their teachers as well as determine whether teachers were highly qualified under new federal regulations (Donaldson, 2009; Heyde, 2013). In 2010, the Illinois General Assembly passed, and Governor of Illinois, Pat Quinn signed, Public Act 096-0861 known as the Performance Evaluation Reform Act (PERA), which changed how teachers' and principals' performance were to be measured in the state. The law affected the teacher evaluation process, the rating scale used to evaluate teachers, seniority guidelines, and Reduction in Force (RIF) rules for public school teachers (Heyde). The law required that by the start of the 2016-2017 school year student growth components would be factored into the teacher evaluation model (Heyde). Thus, it created a teacher evaluation process that has evolved from a teacher-centered checklist to a student-centered evaluation model focused on student engagement and student learning outcomes (Donaldson).

The accountability policies within PERA shifted and changed the teacher evaluation system by using student growth data (i.e. growth and improvement on summative and formative assessments) vs. achievement scores (i.e. the actual score on a specific test); thus the insertion of student growth data as indicators and possible deciding factors for the teachers' evaluation score (NWEA, 2013a) provide teachers an incentive to focus on student growth and identify resources that support student growth.

One possible resource that may support student growth data is the computer-adaptive MAP assessment. This digital assessment has been aligned to the rigorous CCSS and designed to provide a stable continuum for formative, interim, and summative assessments (NWEA, 2014). Assessment snapshots taken throughout the year provide information on each student's academic growth, while supplying multiple data points that can be utilized on teacher evaluations.

For the first time in the history of American education, teachers across the nation share a set of rigorous common standards that assess the students' academic performance by utilizing digital assessments (Tamayo, 2010). Both standards and assessments have placed greater demands on students, and in order to be marked proficient, the new teachers' evaluation mandates have created the need for and required teachers to make use of reliable and valid resources that have been proven to help student growth.

Common Core State Standards

Recognizing the value and need for consistent learning goals across states, in 2009 the Council of Chief State School Officers (CCSSO), which is comprised of state school chiefs and governors and the National Governors Association Center for Best Practices (NGA Center), coordinated a state-led effort to develop the Common Core State Standards. These standards were designed through collaboration among teachers, school chiefs, administrators, and other experts; the standards provide a clear and consistent framework for educators (NWEA, 2013).

Common Core Learning Standards were intended to fill the gaps between the participating states in the nation and provide a commonality to achieve the increasing demand for student achievement and teacher accountability. The innovation focused on several areas of reform, which included improving teacher quality and effectiveness, increasing student learning while turning around low-preforming schools, and developing a data system to be shared among the states for measuring student success (Tenam-Zemach & Flynn, 2011).

The shared curriculum sought to create common academic standards across grade levels throughout the United States (Luther, 2015). The call for such a curriculum was answered by the creation of the Common Core State Standards (CCSS), which were founded on the principles of college and career readiness, technology, and globalization (Daggett et. al., 2010; Dahlin & Tarasawa, 2013; Luther). These new standards have been accepted by many states and are more rigorous than previous standards since they focus on college and career readiness rather than basic proficiency (Daggett et al.; Dahlin & Tarasawa; McGuinn, 2012; U.S. Department of Education, 2009).

A shared curriculum among the states was just the first step; there was also a need to establish a process of assessing the new rigorous college and career readiness requirements (Daggett et al., 2010). Therefore, along with the RTT fund for the states, an additional $175 million was set aside to create an assessment system that would track student data, including performance, ability level, and improvement over time (U.S. Department of Education, 2010).

The educational reform of learning standards and assessment tools has been a constant theme in our country's history. In an effort to keep up with the many countries around the globe, the United States' educational leaders issued a vision for a nationally shared curriculum that would utilize digital assessment to ensure that the students of our nation, upon graduation, are ready for the college and career path (Darling-Hammond, 2014). Thus, the changes in teaching and testing have great implications for the students and teachers to make advancements in knowledge and skills to support 21st century learning.

Digital Assessment Systems

The addition of these policies has provided opportunities for external educational organizations to develop assessments that incorporate technology and curriculum to generate prescriptive models for academic success. Two consortiums, the Partnership for Academic Readiness of College and Career (PARCC) and SMARTER Balance (SMARTER), were established to record and analyze student performance data related to the CCSS. These new digital assessments would increase cognitive demand and offer more tasks that required higher order thinking skills such as critiquing, analyzing, evaluating and applying knowledge (Darling-Hammond, 2014).

States participating in the initiative would have the opportunity to choose which consortium would administer their achievement tests (Daggett et al., 2010; U.S. Department of Education, 2010). These standards and assessments have not only altered the way teachers educate youth but have also changed how students demonstrate their understanding of classroom curriculum.

Computer-Based Assessment

The 21st century computer-based assessment (CBA) has undergone a transformation that enables it to provide dynamic content and results to better identify gaps in student learning. Pellegrino and Quellmalz (2010) explained that successful CBA relies on the use of information and communication technologies such as web browsers, word processors, editing, drawing, simulations, and multi-media to support a variety of research, design, composition, and communication processes. These tools enable a new generation of innovative assessments capable of measuring complex forms of learning, yet they differ from traditional classroom teaching methods. Therefore, as CBA becomes more tightly integrated within the education system, teachers will need to evaluate and adjust classroom practice to provide students with critical and higher-order thinking skills needed to achieve success (Pellegrino & Quellmalz). Specifically, “better methods for capturing and connecting evidence of student learning, both content knowledge and reasoning, and inquiry skills must be implemented across all levels of the educational system” (p. 122).

Clarke-Midura and Dede (2010) further described 21st century assessment as “underway and attempting a breakthrough in the use of technology to improve student assessment [with a] focus … beyond the century-old methods” (p. 310). Advances in technology have provided the opportunity to observe students' depth of knowledge and provide teachers with a unique setting beyond the traditional pencil and paper method of assessment. Clark-Midura and Dede concluded that students have the ability to be transported into a virtual world that simulates complex scientific instruments and situations and allows the enactment of virtual experimentation; thus, students need technology support that not only extends classroom instruction but can transfer learning into achievement.

Computer-Adaptive Assessment

The transition from traditional assessment to digital assessment systems has been influenced by many factors: increased expectations for student achievement in reading, math, science, and communication; increased teacher accountability; adoption of CCSS; and creation of college and career readiness benchmarks (Luther, 2015). Computer-adaptive testing (CAT) is a relatively new assessment system in the K-12 setting that developed from computer-based assessment. CAT has many advantages over traditional standardized assessment because it is shorter, records academic status and growth, and provides immediate feedback on student scores (Wang, McCall, Hong, & Harris, 2013). In addition, the computer-adaptive assessment format can assess knowledge and provide data that identify the learning gaps for each student in a responsive and dynamic testing format.

The adaptive format system uses responses on test items to generate subsequent test questions (Daggett et al., 2010; Tamayo, 2010). For example, if the initial question is answered correctly, the second question will increase in difficulty, while an incorrect response will decrease the difficulty of the second question. The system's reasoning process connects interrelated test items to draw inferences based on individual student's responses to determine how well the student comprehended the task (Herman & Linn, 2013). The initial assessment session utilizes the scores to create benchmarks; that is, benchmarks determine each student's baseline and current academic abilities.

Adaptive learning theory and transfer-appropriate processing framework are interwoven throughout the computer-adaptive assessment system. The adaptive learning theory combines a pedagogical-psychological informational knowledge foundation to create a system capable of individually adapting assessment to the academic ability of each student, while the transfer-appropriate processing framework engages students in the physical format needed to transfer content knowledge without interference or compromise because of incongruent formatting between skill practice and skill assessment (McCrudden, 2011).

NWEA/Measures of Academic Progress

An effective assessment must not only collect data; it needs to ensure that the data are a good measure of the defined outcomes and that the methods are consistent over time. The organization leading the way to help support educational reform is The Northwest Evaluation Association (NWEA, 2013). The NWEA was one of the first organizations to create a computerized adaptive assessment program, the Measures of Academic Progress (MAP) assessment.

The Northwest Evaluation Association (NWEA, 2013) recently implemented a testing format that sought to meet the requirements set forth by the CCSS and utilizes a computer-adaptive algorithm that employs the measurement techniques inherent with CAT. The MAP is a computer-adaptive assessment in the areas of reading and mathematics that can measure and record student academic growth over time (NWEA; U.S. Department of Education, 2012). This type of assessment covers a multitude of competencies in reading, math, and science, including word recognition and vocabulary, reading comprehension, literary responses, number sense, estimation and computation, algebra, geometry, measurement, probability, and problem-solving (Dahlin & Tarasawa, 2013; NWEA). The NWEA has identified and connected the standards with skills that directly pertain to the college and career readiness students should master at each grade level (Dahlin & Tarasawa).

MAP Scoring

In brief, the MAP assessment is an equal-interval measurement score that utilizes a one-dimensional Rasch model grounded in item response theory, which allows the MAP assessment to measure academic growth over time. In addition, the cross-grade scale allows the assessment to track an individual's academic growth across a single assessment over time, and the low standard error of measurement ensures precision in the scoring and analysis of student growth. MAP aims to reduce score regression toward the mean by appropriately leveling questions to the high and low performing student to better recognize students who perform below the mean (NWEA, 2013).

The skills directly pertaining to college and career readiness that students should master at each grade level have been identified. While the skills are consistent over time, it is expected that students' scores will vary from year to year. The NWEA has established the 65th percentile as the benchmark for College and Career Readiness; those who score above the benchmark are classified as on-track and are more likely to be prepared for college or a career upon high school graduation than those students who score below the benchmark. The MAP assessment creates an RIT score that uses an equal interval scale to measure achievement and growth and allows for comparison of students' scores across the nation (NWEA, 2015). An explanation of MAP scoring will be discussed in Chapter 3.

MAP Benefits

This educational innovation measures a student's individual ability and preparedness for the state's standardized tests (U.S. Department of Education, 2012). This benchmark assessment is useful to the classroom teacher because such external tests provide decision-making data for differentiating classroom teaching. Differentiated or individualized instruction leads to student achievement gains and, thus, higher scores on standardized tests and increased district achievement.

As educational reform changes and demands greater teacher accountability along with increased student performance, school districts are searching for innovations that are consistent, valid and reliable and that promote student growth. As a result, many of the nation's school districts have adopted this benchmark assessment system. Further, policy mandates have created a need for digital assessment, which may be one reason MAP is being implemented. It may be functioning as a proxy for the new digital assessments in many school districts. The U.S. Department of Education (2012) reported 20 percent of the nation's classrooms and more than 30 percent of the districts in the Midwest used MAP assessment in 2009. Later statistical reports found that at the start of the millennium, MAP was given to 17,000 students, and by 2003 more than 1,200 school districts across the nation had utilized this digital assessment system to test nearly one million students (NWEA, 2014).

Digital Dilemma

The new Common Core State Standards provide a framework for a new generation of student assessment (Daggett et al., 2010; Tamayo, 2010). The standards are more stringent and rigorous, which means the level of student academic proficiency has shifted. The new common assessments, the PARCC and SMARTER Balance, are digital (NWEA, 2015), so not only do the students have to adjust to the increased learning standards, the students must also transfer their knowledge via a digital format. Traditional pencil and paper learning methods and formats are not congruent to the new digital assessments. Therefore, student transfer of knowledge may be compromised, causing low student performance outcomes on digital assessments. Due to the immense degree to which change has occurred in student assessment, this study examined the congruence between individualized digital learning formats and digital assessments formats.

Homework and Achievement

In one study by Ronning (2011), the findings revealed that the average elementary students who had homework had increased performance scores when compared to performance scores of students who were not given homework. The current educational reform movement has intensified the pressure for educators to increase student performance on assessment. Therefore, nightly homework offers students a chance to complete even more tasks (Sallee & Rigler, 2008), especially since homework has historically been an acceptable means to have students practice the concepts and skills taught in the classroom. Trautwein (2007) examined the effects of homework assignments on student achievement and traced the effects back to the first study conducted in 1927 when Hagan studied 11- and 12-year-old students to determine how homework affected them. Since that initial study, a vast amount of research has examined the direct and indirect effects between homework and student achievement (Cooper, Cavey & Patall, 2006; Cooper & Valentine, 2001; Trautwein, 2007).

This section provides the foundation, overview, and research finding of both traditional and digital homework regarding the value of assigning homework, time spent on homework, homework frequency, and student effort and completion of homework as well as the effect on student achievement. In addition, it also provides background information on Scootpad®, the eLearning platform utilized in the study.

Traditional Homework

Traditional homework assignments usually employ a singular set of pencil and paper tasks assigned to all students to complete during non-school hours (Cooper & Valentine, 2001; Lee & Heyworth, 1997). The rationale for assigning homework rests on the assumption that students first master the concept, then practice the daily skill at home, and as a result, make achievement gains. Meanwhile, the students who did not master the concept have to rely on assistance from others or wait until the next day to ask for the teacher's help. Consequently, the delay in assistance may create unresolved issues that could result in concept misconception in the future (Lee & Heyworth).

Furthermore, traditional homework usually does not address the individual differences of learners, thus widening the learning gap between the low-achieving student and the high-achieving student (Sallee & Rigler, 2008). That is the identical homework assignment for one student may be considered quick and easy, whereas a student who struggles may take a great deal of time to complete it. Although the learning gap can widen in certain instances, many studies show positive results for student performance on traditional homework. Most research supports the notion that homework fosters independent practice and enables students to strengthen the skills learned in the classroom (Cooper et al., 2006; Rosenshine & Stevens 1986).

One such study by Rosenshine and Stevens (1986) analyzed many studies on instructional procedures. The study focused on teacher delivery of instruction in a fixed format and found that when the teacher employed and followed the specific steps of review, homework check, feedback, and active seat-work within the lessons, student achievement increased in mathematics. Additionally, Rosenshine and Stevens noted that using a systematic well-structured procedure of feedback and correctness of homework assignments helped the teacher identify and monitor the areas in which students needed additional instruction. As a result, Rosenshine and Stevens suggest teachers should utilize homework to individualize the student's instructions and address any learning deficits before the student is assessed.

Cooper et al. (2006) conducted a meta-analysis of 68 research studies from 1987 to 2003 to parse out the impact homework has on student achievement. Due to the differences in research methodologies and criteria used to analyze the results across the studies, the overall findings were inconclusive for elementary school students and student achievement was low ($r = .05$); however, the correlation was larger for students in grades 7 to 12 ($r = .25$). Overall, Cooper et al.'s primary focus was on the achievement outcomes with predictors, not homework, as the primary factor. The study concluded that homework appeared to have positive effects on student achievement, but the strength of the relationship varied across student grade levels. Although the present study is limited to the abovementioned areas, the meta-analysis provided additional information, specifically, factors that affected the utility of homework, optimum amounts of homework, and biases and generalizations utilized in the research synthesis (Cooper et al.).

Trautwein (2007) analyzed three international mathematical data sets for students in grades 7 to 9. The purpose of the study was to better understand how time spent on homework, homework frequency, and homework effort affected student achievement scores. The results showed homework assignments positively impacted student achievement through two key mechanisms: frequency of homework and effort displayed toward homework. Thus, the amount of time a student spent on homework did not improve his or her achievement scores. These results suggest that if a student does not understand the concepts covered in the homework assignment, spending more time on the assignment will not likely benefit the student's learning. This may be especially true for homework that is graded, as receiving a poor grade on homework may decrease the student's self-efficacy for the specific content area (Cooper, et al., 2006).

Following the work of Cooper et al. (2006), Pelleteir and Normore (2007) examined the differences of students in grade three and the relationship of those differences to the student's homework performance, student characteristics, and perceptions of and challenges on teacher developed assessments and standardized assessments. The participants were third grade students taught by seven different mathematics teachers. In contrast to Cooper et al.'s findings of almost zero effects of homework on grades three through five achievement scores, Pelleteir and Normore's study suggested that student homework performance was a strong predictor of academic success in mathematics on teacher-developed assessments, but not as strong on standardized assessments. Further, the students' perceptions and the students' challenges were a strong predictor of the students' average test scores. The researchers hypothesized that the positive results on the teacher developed test were because both the homework assignment and the test format were similar, while the standardized assessment was a different testing format developed by a publisher (Pelletier & Normore).

Further research by Kitsantas, Cheema, and Ware (2011) investigated how homework resources, mathematics self-efficacy, and time spent on homework impacted mathematics achievement across gender and ethnicity. The findings are contradictive to previous studies; the study reported that increased proportions of homework time spent on mathematics decreased mathematics achievement. Their findings suggested the approach to homework assignment structure was important; thus, teachers need to utilize homework resources focused on the academic and self-efficacy needs of each student.

There is a plethora of studies on homework and academic achievement, and although there are mixed results, overall research supports the assumption that homework is substantially related to student achievement. In the discussion section of the abovementioned studies, it was recommended that teachers should utilize homework with a clear and concise purpose to support academic achievement.

Digital Homework

As a result of the interaction fostered between the digital eLearning platform and the student, many digital eLearning platforms mirror those of one-on-one tutoring programs. One technological advancement that may impact student achievement is the use of digital eLearning homework platforms, defined as “a system of computerized problems that is available online with the capability to automatically grade answers and provide immediate feedback on the correctness of the solutions” (Leong, 2013, p. 76), and assigned by the classroom teacher to replace the traditional pencil and paper homework assignments.

There is a dearth of research that has specifically focused on digital eLearning platforms used for homework, and at the time of this study there was no empirical research found regarding the effect of digital eLearning platforms on the new generation of digital assessments for elementary school students. These investigations have primarily examined the relationship between digital technology environments and their impact on traditional assessment, but they have failed to examine digital eLearning platforms used for homework to supplement classroom-based instruction (Clarke-Midura, & Dede, 2010; Daggett et al., 2010; Leong, 2013; Pellegrino & Quellmalz, 2010).

One of the earliest studies utilizing a digital homework system was a two-year investigation of an introductory physics course in 1999-2000. Cheng, Thacker, Cardenas, and Crouch (2004) investigated students taught by interactive engagement (IE), a non-interactive engagement with non-graded homework (NIE), or with online homework (OHW). The results were statistically significant between ungraded and graded homework; but there was no significant difference in the OHW to students with traditional paper-and-pencil graded homework based on posttest scores.

Researchers have shown an increased interest in studying the effects of digital technology on student achievement, specifically in the content areas of business, mathematics, and problem solving at the college level (Gecer & Dag, 2012; Leong, 2013; Raines & Clark 2013). One topic that several studies have examined is the use of technology in a blended learning setting; a blended learning environment is defined as face-to-face (i.e., offline) instruction with online support that measures students' learning and achievement (Gecer & Dag).

A 2010 meta-analysis reviewed 99 empirical studies conducted between 1996 and 2008 that examined the effectiveness of online eLearning platforms (Means, Toyamo, Murphy, Bakia, & Jones, 2010). To be included in the meta-analysis, each study had to feature web-based online technology support, in which random assignment or controlled quasi-experimental designs with a primary research question compared an online learning environment to a blended learning environment.

Means et al.'s (2010) meta-analysis included a set of 50 contrasts, and of those individual study effects, 11 were significantly positive and favored the online or blended learning environment over face-to-face instruction. Contrary to these findings, three of the contrasts showed significant effects for traditional face-to-face learning. In all of the studies, instruction that utilized a blended learning environment had a larger effect ($d=.35$, $p<.001$) relative to face-to-face instruction than did only online instruction ($d=.05$, $p=.46$). However, the research also found that not only does the environment affect learning outcomes, so does the amount of collaboration in which students engage. For example, the mean effect sizes for studies that examined collaborative instruction ($d=.25$) and instructor-directed instruction ($d=.39$) were larger than studies examining independent learning ($d=.05$). Furthermore, out of the 13 studies analyzed for this effect, two of the studies that used blended and collaborative models of instruction showed a significant effect on student achievement. Finally, Means et al.'s meta-analysis revealed a large variation in the content learner types included in the studies. The majority of the studies were conducted using samples of college or community college students. Nearly half of the studies examined content in the subject area of medicine/healthcare, while the other half were spread out to include high school and middle school mathematics, computer science, languages, science, social science and business.

It is important to note that of the original 99 studies considered for the meta-analysis, only nine involved K-12 student instruction, and within those nine studies, only five met the meta-analysis criteria (Means et al., 2010). After a closer review, Means et al.'s determined that three of the studies that favored blended learning environments resulted in a positive mean effect, yet they further concluded that the number of studies was too small to warrant much confidence in the mean.

A more recent study that included 28 fifth grade students resulted in a large effect size of .61. Mendicino et al. (2009) compared learning for fifth grade students in two mathematics homework conditions, traditional paper and pencil, and Web-based homework. The mean gain for the Web-based homework group was 1.14 points out of 10 points (Mendicino et al.). The results of this study support the effects of immediate feedback, while suggesting that one-to-one computing supports individual students' learning needs that, in turn, will improve student achievement.

Rethinking homework in the 21st century classroom is a necessary step in the improvement of student academic performance (Sallee & Rigler, 2008). Furthermore, the shift in the administration method of standardized assessment tests has implications for both teachers and students (Daggett et al., 2010). Given that computer adaptive standardized assessments are in a nascent stage, there remains much to be uncovered about the strategies and methods that lead to successful student performance outcomes. The extant literature has primarily compared online platforms to traditional classroom environments, but it has failed to highlight how online platforms can be used to supplement classroom concepts via digital homework and/or improve student digital assessment scores. Additional research is needed to examine the full impact that digital technology has on the transfer of student knowledge and achievement.

There is limited research on technology-driven homework, and as such, very little is known about how computer-based homework assignments affect performance on subsequent computer-based assessments. The present study aimed to fill these gaps by focusing exclusively on elementary school students who utilized a digital eLearning platform, Scootpad®, for daily homework assignments affected the students' scores on digital assessments. Thus, this study sought to provide both theoretical and practical contributions to the field with the ultimate goal of improving student academic performance outcomes.

Scootpad®

ScootPad® is a for-profit computer-adaptive electronic learning (e-learning) platform capable of personalizing and accelerating learning through the use of adaptive algorithms, predictive analytics, data visualization, and gamification to self-motivate students to practice and compete with their peers (Kumar 2014). ScootPad® was founded in 2011 and launched in 2012 by Bharat Kumar and Maya Gadde.

The mission of ScootPad® is to transform learning, accelerate results, and enable students to achieve their full potential. The vision is to provide easy-to-access learning opportunities to millions of students around the world (Kumar, 2014). In addition to the mission and vision, the founders' approach "is to deliver totally refreshing ways of learning with data-driven and breakthrough technology."

Since the inception of ScootPad®, several milestones have occurred. In 2013, 600,000 students signed up for a ScootPad® account, and by 2014, the total amount of student accounts was 1.3 million. The company's 2015 goal was to obtain over two million subscribers. With the growth, Kumar and Gadde created a Teacher Advisory Board of over 50 members and a diverse team of engineers, content designers, implementation experts, and advisors (Kumar, 2014). In addition to these individuals, companies such as Google® and Schoology® have become partners (Kumar, 2014). ScootPad® will be described and addressed in further detail in Chapter 3.

Not all homework is completed and not all children complete the homework; this may be because homework is completed during non-instructional times and requires students to regulate their thinking, affect, and behavior (Kitsantas et al., 2011). Zimmerman and Kitsantas's (2005) research is one example that supports the findings of the self-regulatory processes. The processes of goal setting, self-monitoring, strategy use, and self-evaluation play an important role in the completion of homework. Zimmerman and Kitsantas's study of high school girls examined the mediational role of self-efficacy for learning and the perceived responsibility beliefs between students' homework reports and academic achievement. The results showed that homework, self-efficacy, and self-regulatory responsibilities predicted students' grade point averages (GPA). The findings support the belief that the role of homework is beneficial, and evidence showed a positive impact on student performance (Zimmerman & Kitsantas). In addition, they found that students who engage in self-regulation tended to have higher homework completion and academic performance growth.

Further research by Bembenutty (2011) took into consideration the role of self-regulation on assigned homework activities. The findings supported a positive relationship between homework and a range of self-regulated learning skills – meaning, homework assignments can also enhance the development of self-regulation processes (Bembenutty). Although this study did not address digital eLearning platforms used to complete homework, it did examine homework completion in the digital age. Bembenutty suggested that to help the *i*-generation, or students born after 1982, teachers need to instill the value of homework by teaching students to set academic goals, train them in time management, and engage them in self-reflection about homework completion.

Conceptual Framework

The selection of conceptual and theoretical frameworks in a study is a complex matter. A brief background description of the memory acquisition model is included because the study of memory correlates to assessment; that is, most assessments require the examinee to utilize recall, cued recall, and recognition to access information from memory (Morris, et al., 1977). While an examination of Bloom’s (1984) study on the use of one-on-one tutoring will be described to better understand the role that computer-adaptive eLearning homework platforms may play in assisting in the growth of academic performance, the Transfer-Appropriate Processing (TAP), Adaptive Learning Theory, and the Theory of Self-Regulation and Self-Regulated Learning are the theoretical and conceptual lenses that were utilized to investigate and analyze the findings of this study.

Memory Acquisition

In the 1970s, the memory model was the popular model used to understand human memory. The model emphasized dual memory storage, which suggested that the memory had only two levels: short term memory (STM) and long term memory (LTM). Further, Criak and Lockhart (1972) proposed that memory was enhanced more by depth of processing than by how long information was rehearsed. That is, it was suggested that if the rehearsal was applied in a deep and meaningful way, memory retrieval would be more effective. Criak and Lockhart’s study concluded that memory occurs on a continuum from shallow to deep; the shallow was the superficial level of memory, while meaning and association of memory were stored in the deep level. For example, when a learner analyzes for meaning and uses personal experiences and connections to comprehend the information, connections will be made and stored in the deep level of memory, thus making recall meaningful and easier to locate and retrieve (Smith & Kosslyn, 2007).

Later research by Morris and his colleagues (1977) expanded on Criak and Lockhart's (1972) notion that if the term learning is synonymous with learning a list of inputs or answers and a test is a test of memory for these inputs, then the process of the acquisition is assessed in relation to the goal of remembering the inputs. That is, assessment is the recall, the cued recall, and the recognition of the instruction and activities used by the examinee to show understanding of concepts learned on a test. Morris et al.'s study focused on the idea that particular acquisition activities are never superficial or non-meaningful, and the study concluded that "task meaningfulness must be defined relative to particular learning goals" (as cited in Smith & Kosslyn 2007, p. 519); that is, one must have transfer-appropriate learning similar or congruent to the assessment in both content and test format to comprehend and show one's full understanding (Morris et al.).

Transfer-Appropriate Processing Framework

The 1977 work by Morris et al., titled "Levels of Processing versus Transfer-Appropriate Processing," is considered to be a landmark in the study of memory (as cited in Smith & Kosslyn 2007). Morris et al. hypothesized that "the level of processing at encoding does not influence later memory performance in isolation, but rather memory depends on the overlap between the processing engaged at encoding and at retrieval" (Smith & Kosslyn, p. 523). That is, the learners must be taught the content in the format of the assessment, as it may be the congruency between the lesson taught and the assessment given that is important.

Morris et al. (1977) used TAP in encoding (semantics and rhyme) and retrieval tasks (standard and rhyming recognition). The results of the study showed that participants correctly recognized the items that were consistent with the context at encoding. Additionally, data showed that how the participants were instructed affected the response. The closer the words were related to the instruction and the goal format of the test, the more likely the participant answered the question correctly (Morris et al.). Therefore, TAP's framework supports the theory that when memory is probed, performance will be greater if the processing during encoding (instruction) can be overlapped and extended to the retrieval and transfer of the items (Morris et al.).

Since the inception of this framework, many studies have utilized the TAP framework to account for and explain how memory can influence student performance (Blaxton, 1989; Eckhardt, Urhahne, Conrad, & Harms, 2013; McCrudden, 2011; Reed, Corbett, Hoffman, Wagner, & MacLaren, 2013). It was Roediger, Gallo, and Geraci (2002) who identified and summarized the four assumptions that have emerged from the previous studies:

1. Memory tests benefit to the extent that the operations they require overlap or recapture the operations used during encoding.
2. Most, but not all, explicit and implicit memory tests rely on different types of processing.
3. The most standard explicit memory tests depend primarily on meaningful information for successful performance.
4. The most implicit memory tests in standard use rely on perceptual information.

These assumptions are examined to identify factors that can affect student performance and the possible steps to minimize such limitations, thus strengthening the validity of the study's assessment scores. These assumptions build on Bloom's (1984) premise that student performance can be affected by the instructional method. Scootpad®, the computer-adaptive eLearning platform for homework being used in this study, was developed based on the findings of Bloom's study (Kumar, 2014); therefore, Bloom's study will be briefly described.

One-On-One Tutoring

The transfer between concept practice and concept assessment is important for student achievement, but when TAP is used in conjunction with individual instruction, significant gains may occur. Early research on the benefits of one-on-one tutoring (Bloom, 1984) compared the effects of the conventional teaching model of 30 students per teacher and the tutoring one-on-one teaching model. Bloom found that the students in the treatment intervention group (one-on-one tutoring) outperformed those who received conventional instruction from the teacher. In fact, the tutored students showed student achievement growth of two standard deviations above the conventional control group's achievement growth. Furthermore, Bloom contended that

> if a practical method could be established that could yield student achievement of two standard deviations, then it would be an educational contribution of the greatest magnitude and … would have significant effect on what schools can and should do with the educational years. (p. 5)

The rapid technological advances in the late 20th century and the early 21st century may finally usher in the reality of Bloom's quote. ELearning has emerged as a tool for knowledge management and has the capability to individualize a student's learning and increase performance scores (Karmaker & Nath, 2014). Although there are many popular views of personalized instruction, Bloom (1984) conducted a study that introduced the concept of mastery learning wherein content and skills to be learned are organized into individual units (Murray & Perez, 2015). Mastery learning presents instruction, formative assessment is conducted, feedback is provided, and then remedial instruction is given to individuals to correct any misconceptions. This cycle continues until mastery is achieved. Bloom's study compared three student learning conditions of instruction: *Conventional* students learn content in a class with an average of 30 students per teacher and testing was used for a "quarter grade." *Mastery Learning* students learn content in a class with an average of 30 students per teacher, but testing was formative and used by the teacher to provide feedback to the student to correct the gaps in understanding. *Tutoring* allows students to learn content with a one-on-one tutor, and formative assessment paralleled the mastery learning class.

Bloom's (1984) findings led him to conclude that if researchers "could find practical methods, that is, methods that teachers could learn in a short period of time, and utilize with little more cost or time than that of conventional instruction, it would be an educational contribution of the greatest magnitude" (p. 5). Computer-adaptive learning may prove to be the contribution Bloom was speaking of (Thompson, 2014). Current research has explored the hypothesis that adapting to a learner's specific learning needs results in better learning outcomes (Reed, et al., 2013). It is on this basis that the adaptive-learning theory is presented.

Many of the digital homework platforms possess the characteristics of Bloom's (1984) one-on-one tutoring model: interaction with the teacher, positive reinforcement and encouragement, active engagement, and constant and corrective feedback. It may be on this statement that many digital eLearning platforms have established roots. In the current study eLearning platforms steered and offered ways to engage students through a one-on-one interaction, that is the platform identified each child's needs based on the responses and then modified the learning path for practicing the material.

Adaptive Learning Theory

As technology advances and becomes more sophisticated, its use in today's classrooms becomes more student directed, and it may be utilized to support a more individualized learning experience. The theoretical model of adaptive eLearning education illustrates a program's ability to automatically adapt to specific learning requirements of students through the creation of an expert system program.

Murray and Perez (2015) defined adaptive-learning theory as a computerized approach to instruction and remediation that employs a sophisticated data-driven learning experience; this experience adapts to the learning needs of learner. The interactions made between the adaptive-system and the learner are conducted at the learner's performance level. The computer-adaptive system can predict from previous responses and adjust the level of the content questions. The adaptive learning tools are technology-based artifacts that interact with learners and vary presentation based on the learners' interaction with the adaptive-system; this type of process can help to advance learning achievement levels. An adaptive eLearning model's structure is comprised of three modules: the student module, the author module, and the adaptive module (see Figure 2.1).

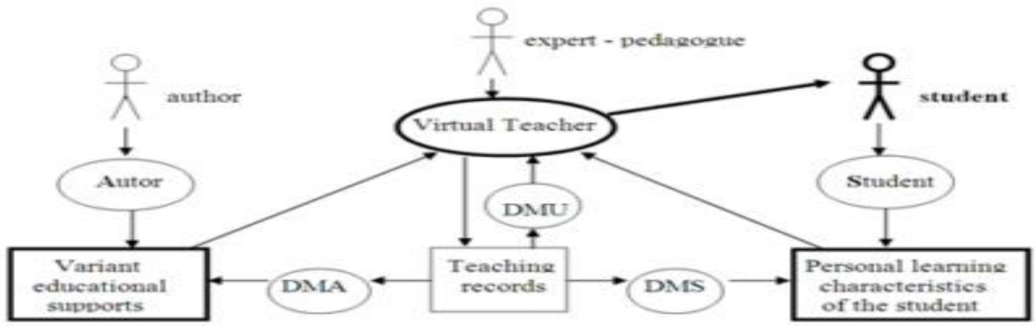

Figure 2.1: Theoretical model of adaptive education environment. (DMA, DMU, DMS = data manning from author, teacher, student)

The program is constructed to meet each student's individual learning needs; therefore, information about the student's learning is gathered so the program can adequately react to the student's current knowledge and learning characteristics. The right part of the diagram, the student module (DMS), uses tests or a questionnaire to identify student characteristics; then metadata or the findings are stored in and retrieved from the program's database (Kostolanyova, Sarmanova & Takacs, 2012). The left part of the diagram is the author (DMA). Its function is to save or modify the aids for teaching, such as texts, pictures, multimedia, etc. The ellipse in the middle top section is the virtual teacher (DMU) and the actual managing program. "The virtual teacher will then load all the required information about the student, all the information about the structure of the given teaching material, and determine – on the basis of this information – optimal education method" (Kostolanyova et al., p. 61). A combination of pedagogical-psychological knowledge, along with this information, will create a detailed plan of the education process "comprised of a certain expert system that contains basic pedagogical rules, which it then uses to create optimal teaching style for a specific student with an optimal guidance through specific teaching material" (p. 55).

There is no doubt that technology has transformed education, but the precise impact technology has on individual learners remains in question. This study examined the possible effect(s) that a diversified data-driven instructional supported learning system (Kumar, 2014) has on student performance.

Self-Regulation

Discussion, demonstration, lecture, and practice are the most typical strategies implemented by teachers to support instruction (Silver, Strong, & Perini, 2007). However, in the past 50 years, researchers have studied and revised strategies to meet high academic standards and the different learning needs of the students in today's classrooms (Silver et al.).

Self-regulation has been studied through many different lenses; this study focused on self-regulated learning strategies that have proven beneficial to the completion of homework and the increase of student achievement. These learning strategies include goal setting, self-evaluation, and self-explanation. Early studies that led to these conclusions are summarized to better understand self-regulated learning and the strategies used to support this concept. The following section will briefly define self-regulation and a process model for determining student self-regulation. A review of the literature and description of the self-regulated learning strategies employed in this study are also presented.

Self-Regulated Learning

As stated in the previous chapter, self-regulated learners have been defined as students who are motivationally, metacognitively, and behaviorally active participants in their acquisition of knowledge (Zimmerman, 1986). Student learning can either be active or passive, while motivational differences of each student allow the students to act or react to a variety of factors; these factors can either be internal and external (Ryan & Deci, 2000). Together intrinsic and extrinsic motivation are perhaps the variables that produce and maintain self-regulation. *Intrinsic motivation* is the inherent tendency to seek out novelty and challenges to extend one's capabilities, to explore, and to learn, whereas *extrinsic motivation* refers to the performance of an activity to attain some separable outcome (Ryan & Deci). Therefore, understanding that self-regulation is impacted by both intrinsic and extrinsic motivation serves a purpose during the assignment and application of specific self-regulated learning strategies for each student (Stoeger & Ziegler, 2011).

To date most studies pertaining to self-regulation have involved post-secondary and college students (Stoeger & Ziegler, 2011), while studies on self-regulated learning with elementary-school students have been rare. However, one of the earliest studies by Warton (1993) investigated elementary students' perceptions of self-regulation at ages 7, 9, and 11. Warton linked self-regulation criteria to student responses regarding their perceptions of responsible homework practice. The study correlated the students' ages with the types of homework practice responses given. The findings revealed a broad developmental progression and an age-related shift in students' understanding of both the purpose of learning and the ability to recognize and accept personal responsibility for homework completion. The findings indicated that self-regulation perceptions may be present in students as young as seven and that their perception toward responsible homework completion increases as they grow older. Therefore, elementary-aged students have been shown to possess the ability to self-monitor behavior and self-regulate their learning.

Warton's (1993) findings provided the foundation for future studies of elementary school children and self-regulation (i.e., SRL strategies or treatment interventions). In addition to these findings, the cognitive and metacognitive development and maturation of this age group were considerations for the current study.

Cognitive Development

Cognition can be defined as the capability of learning and constructing meaning, while metacognition is the ability to understand how meaning is applied to one's thinking (Schunk, 2012). Patterson (2008) observed students 9 to 11 years of age who were transitioning from the middle childhood stage of development to the adolescent stage of development. Patterson found that by the end of this stage, students' brains have reached 95% of their full adult size and their sense of self becomes increasingly complex. The students' cognitive development during this stage supports the increasingly complex mental capabilities needed to support self-regulation, which Schunk defines as the deliberate attention to and regulation of one's behaviors. Although there is no definitive age marker for the onset of self-regulation, an individual must be capable of selecting and utilizing learning strategies to achieve desired academic outcomes from feedback (Schunk). During this transition between stages, most students are more cognitively capable and possess the ability to apply learning strategies to enhance self-regulation (Patterson; Schunk). Subsequently, the development of the students' cognitive and metacognitive capability and the ability to apply learning strategies to self-regulation are an important aspect of the current study.

Self-Regulated Learning Process Model

A process model guides the instruction of specific self-regulated learning methods and procedures that have been proven to develop the students' awareness of their learning. In the field of education, the process model by Pintrich (2004) has been proven to be both valid and reliable in predicting student performance scores. The model utilizes the responses from the Measures of Learning Strategy Questionnaire (MSLQ), a self-reporting questionnaire that measures motivation as well as cognitive and metacognitive responses and supports four self-regulated learning strategies: rehearsal, elaboration, organization, and metacognition (Anthony et al., 2013). This framework assumes that motivation and learning strategies are not fixed traits of the learner, but instead that "motivation is dynamic and contextually bound and that learning strategies can be learned and brought under the control of the learner" (Duncan & McKeachie, 2005, p. 117). Based on the needs of the researcher, Pintrich's model can be utilized in its entirety or can be broken into 15 subscales. A detailed description of the MSLQ is presented in Chapter 3.

Although the MSLQ framework was developed to measure undergraduate college students' motivation and self-regulated learning as they related to a specific course (Duncan & McKeachie, 2005), empirical studies have shown that the MSLQ is predictive for measuring students' self-regulated learning in K-12 grade levels on both traditional and digital performance scores (Eom & Reiser, 2000; Orhan & Koskeroglu, 2009). As a result, the Pintrich (2004) process model was utilized in the current study.

Traditional Studies Using the MSLQ

Yamac and Ocak (2013) examined predictors and the relationship among fifth graders' self-regulated learning strategies, motivational beliefs, and attitudes toward mathematics and academic achievement. A sample of 204 students completed the MSLQ as a data collection tool. Based on the findings, metacognitive self-regulation, self-efficacy, task value, and intrinsic goal orientation predicted the attitude toward mathematics, while self-efficacy and test anxiety predicted the achievement. In addition, task value, self-efficacy, and intrinsic goal orientation predicted self-regulated learning strategies (Yamac &Ocak). That is, intrinsic goal orientation predicted achievement, but extrinsic goal orientation was not to be found to be a predictor of achievement.

Another recent study (Anthony et al., 2013) examined the role of self-regulation and various SRL strategies to determine the possible effects these strategies may have on student achievement. Anthony et al. studied the learning strategies students used when preparing for final exams in English and mathematics. One hundred and sixty high school girls completed the MSLQ and an open-ended questionnaire designed to assess student use of learning strategies. The researchers reported mixed findings about whether the MSLQ's language was clear when the students tried to align and adapt the items to their own learning strategies. Anthony et al. hypothesized the students' language was often simpler and less abstract than what was found on the MSLQ items. Yet, the results indicated all of the variables were either moderately or strongly positively correlated for both subject domains and in line with theoretical predictions.

Digital Studies Using the MSLQ

Eom and Reiser (2000) examined the effects of self-regulated learning strategies on the achievement and motivation of 37 sixth graders taking a computer-based course. The purpose of the study was to examine how the varying amount of learner control within the computer-based course might affect the achievement and motivation of students who considered themselves as either high or low self-regulated learners. The researchers utilized the Self-Regulatory Skills Measurement Questionnaire (SRSMQ), an adaptation of the learning strategies component of the MSLQ.

Results of the study showed that regardless of how the students rated their self-regulating learning skills, students in the program-controlled condition (i.e., students who had very little control over their progression through the course) “scored significantly higher on the posttest than did the students in the student-controlled condition” (Eom & Reiser, 2000, p. 247). Furthermore, students who rated themselves as low self-regulated learners scored much better on the posttest, approximately 76.4%, when taking the program-controlled condition as compared to the learner-controlled condition. The results suggest that students with low self-regulating skills were not able to learn from the computer-based course that provided high quantities of learner-control.

Orhan and Koskeroglu (2009) investigated sixth, seventh and eighth grade students to determine whether the perceptions of task values for the computer literacy course were different according to gender, having computers at home, and grade level. Data were collected from 601 students through the task value subscale on the MSLQ. The results show a significant difference by grade level in the students' task value for computer literacy courses regarding having a computer at home, but there was no significant difference by gender.

Overview

The abovementioned empirical studies have provided an account of the variations in which the MSLQ has been utilized. The instrument has been proven to be an effective measurement for performance outcomes on both traditional and digital assessment scores at K-12 grade levels. However, it appears that, to date, the instrument has not been used with a computer-adaptive homework platform and a computer-adaptive assessment system. As a result, the current study utilized the MSLQ to establish a baseline for understanding student performance outcomes on computer-adaptive assessments.

Self-Regulated Learning Strategies

Students adjust to learning through effective learning strategies (Dunlosky, 2013), and there are many learning strategies to teach students how to self-regulate their learning. One factor to consider when establishing an SRL strategies lesson is that the lesson should benefit one of the four categories of variables in education: learning conditions, student characteristics, materials, and criterion tasks (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013).

Utilization of SRL strategies has been proven to increase academic achievement, but no single strategy can respond effectively in every teaching situation (Silver et al., 2007). Therefore, research (Dunlosky et al.) has examined specific research-based teaching strategies that may support goal setting, self-evaluation, and self-explanation. Thus, implementing specific teaching strategies in conjunction with specific SRL strategies may help teachers focus on both the learning strengths and limitations of the students.

Goal Setting/Self-Evaluation

Dale Schunk, the seminal researcher on self-regulation, conducted many studies that implemented SRL strategies. These studies provided empirical support of the positive effects of SRL strategies on student achievement. One of Schunk's (1994) earliest studies investigated elementary writing that utilized either an SRL goal with teacher feedback or a performance goal with little direction from the teacher. The findings indicated that a process goal strategy, rather than a performance goal strategy, led to the highest levels of self-efficacy, strategy use, and writing skill. That is, the process through which one gets to the goal is more important than performing the goal. Student achievement was greater when the process, not just the finished product, was emphasized.

Later, Schunk (1995) extended his research to include writing assignments by college students. In Schunk's 1996 study, both self-regulated goal setting and student self-evaluation strategy (a slight modification in the variable) were used. Students were asked to judge "how well they performed on a computer task" (competency) and "how often they performed the computer task" (frequency). The findings showed a significant and positive correlation between the competency and frequency of the strategy's use. In addition, the self-efficacy of the students was also significantly higher. Schunk suggested that "learning goals are important for self-regulation and self-evaluation is important when it is frequent" (p. 21).

Another study conducted by Schunk (1997) investigated elementary student performance in mathematics. The study utilized the SRL strategy, goal setting, and the self-evaluation strategy together. His findings showed performance was significantly higher for students who used both strategies than it was for the control group who utilized only the SRL strategy of goal setting. Schunk concluded that when students are given the opportunity to self-evaluate, their progress of academic learning performance scores increase.

Schunk's (1994, 1995, 1996) studies show a positive correlation between the SRL strategies of goal setting and self-evaluation at both elementary and college levels in two subject fields. Thus, goal setting in isolation showed positive effects on student achievement, but student achievement was even greater when a self-evaluation learning strategy was utilized in conjunction with the SRL strategy of goal setting. Further, these findings surmised that learners from elementary to college level can benefit from the SRL strategy of goal setting when followed with a self-evaluation learning strategy. Therefore, learning will be increased if the first strategy helps the learner acquire skills focused on the process of attaining goals and then using another strategy to evaluate the steps taken to achieve the goals.

Building on Schunk's (1994, 1996, 1997) research, studies (Bembenutty, 2011; Gonzalez, 2013; Kitsantas, et al., 2009) have documented the importance of self-regulation and the implementation of a variety of strategies that support SRL and improve student achievement. These studies concurred with many of the abovementioned studies in that student achievement increased when an SRL strategy was implemented along with self-evaluation. Kitsantas et al. (2009) examined the predictiveness of the SRL strategies and goal orientation of fifth grade elementary students. Their results showed that goal orientation was not a significant predictor of student achievement, but the use of SRL strategies accounted for a significant amount of variance in students' academic achievement (Kitsantas et al.).

Gonzalez (2013) proposed that SRL was a self-directed process in which students transfer their mental abilities into academic skills, that is self-generated thoughts and behavior that are oriented toward achievement goals with the interaction of environmental conditions. Therefore, the act of goal setting is a cognitive strategy, while metacognitive strategies are used to ensure that the goal has been met. Gonzalez's study proposed the Structural Equation Model (SEM) for analysis, which showed the following results: the perception of a classroom learning goal structure relates significantly to a personal learning goal orientation and the latter relates positively to the use of metacognitive strategies. Interestingly, students in the study perceived that the goal for engaging in academic work was not to prove competence but to avoid demonstrating lack of competence.

In another study Kitsantas et al. (2009) reported mixed findings. They concluded that prior achievement and the use of SRL strategies justified academic achievement, but the goal setting learning strategy was not a significant predictor of elementary student achievement. The researchers determined that the inconsistent findings might be due to maladaptive behaviors and the small sample size of the study, possibly skewing the results. An additional study by Bembenutty (2011) revealed that for the learner to gain SRL, achieve homework completion, and have an increase in achievement, both the teacher and the learner must be part of the learning process.

Self-Regulated Learning and Technology

At the beginning of the 21st century, most research on technology analyzed higher education and the effectiveness of online learning systems utilized by college students (Cheng, et al., 2004; Clarke, 2010; Martin, Klein, & Sullivan, 2007). Few studies had examined the impact of technology on student achievement at K-12 levels. However recently, a steady increase in studies pertaining to K-12 students' academic performance utilizing technology has been noted (e.g., Aydemir, Ozturk, & Horzum, 2012; Ronning, 2011). The more recent studies recommend that educators should determine students' technological capacity and needs and that both the students and the teachers must be proficient in the use of digital tools (McShane, 2014).

In a 2012 study, Eckhardt et al. examined the effects of two different instructional interventions as support for scientific discovery learning using computer simulation. The results demonstrated that learning with a computer puts a high demand on a learner's self-regulation. In the study, the students received instructional support for data interpretation, for self-regulation, or both. However, the students who received both interventions had the highest value of perceived cognitive load. Unlike previous research on SRL strategies, these findings imply that only a certain amount of instructional support can help learners improve their performance in a multimedia learning environment; therefore, a high cognitive load will not produce positive learning outcomes (Eckhardt et al.). However, demands imply that learners can acquire new content in an autonomous and meaningful way, which means that when implementing a computer program design, instructional strategies should support domain specifics, both factual and conceptual, and should be structured to permit the SRL process (Eckhardt et al.).

Luther (2015) investigated the preparedness responses of teacher-librarians and classroom teachers in 24 school districts via an online survey on the use of Web 2.0 technologies. The participants were digital immigrants, an individual who was born when computer use was mostly limited to the military or remember a time when computers were not a part of their everyday life (Gardner & Davis, 2014). Along with her findings that revealed teachers' concerns about policy and professional development issues, Luther concluded that "technology is a major component of CCSS and culminating in many students completing the Partnership for Assessment of Readiness for College and Careers (PARCC) online assessment" (p.47). Therefore, Luther believed that certain strategies must be implemented to make technologies useful for student assessment, such as the implementation of goal setting.

Research-Based Models

Teaching models reflect beliefs about learning and provide a framework to assist in building the structure for instructional planning and delivery of curricula, which helps educators target specific learning goals (Silver et al., 2007). Additionally, research-based models (Dunlosky, 2013; Gonzalez, 2013; Perels Dagnath, & Schmitz, 2009; Zimmerman, 2002) for teaching take into account the behavioral, social, and interpersonal effects on metacognition and volition. *Metacognition* is used to implement self-regulation for planning, monitoring, or evaluating learning activities, whereas *volitional* controls motivation and emotion (Gonzalez; Perels et al.). Since no single strategy can respond effectively in every teaching situation, the research-based teaching models and strategies take into consideration both metacognition and volitional to support and have positive effects on student learning; (Dunlosky; Gonzalez; Perels et al.). These teaching models include specific strategies, which are the tools that provide direction in implementing, evaluating, and adjusting to meet the needs of each learner as well as to support each teaching lesson objective.

Strategies

A student's level of self-regulation has been proven to support academic performance, but when students utilize an SRL strategy, research has reported an increase in student scores

(Schunk 1994). However, research shows the greatest growth in the students' academic performance scores occurs when students utilize a combination of SRL strategies (Schunk, 1996). These strategies are tools that help students expand their repertoire of learning skills (Silver et al., 2007) and help students take responsibility for their own learning (Joyce et al., 2015). The strategies reviewed in this section focus on skills that support SRL in the areas of goal setting, self-evaluation, and self-explanation and promote the positive development of academic performance.

Goal Setting

The SRL strategy of goal setting is an important developmental task (Schunk, 2012). Goal setting initiates the decision to make a commitment to attain a particular goal and the exertion of a direct act to meet task demands over a period of time. The SRL strategy is taught as a self-directed process in which students transform their mental abilities into academic skill (Gonzalez, 2013). Steps toward effective goal attainment include attention given to the relevant task and selection of the appropriate activities needed to obtain the goal.

In addition to the abovementioned steps, specificity, proximity, and self-set goals are also important factors to consider. Attention to specific goals will provide a clear standard against which self-evaluation will determine progress (Gonzalez, 2013). Realistic self-set goals help short term goals turn into long term goal attainment, thus enhancing motivation and self-efficacy (Schunk, 2012). That is, students will learn through the SRL strategy, goal-setting, how to stay focused on the task, how to select and apply the appropriate means needed, and how to monitor their goal progress (Schunk).

Direct Instruction Model

Direct instruction is utilized during the goal setting process and provides positive effects in regard to student motivation, learning, and self-efficacy (Schunk, 2012). The direct instruction model (Becker, 1977) has a strong academic focus that produces greater student engagement and achievement (Silver et al., 2007).

Direct instruction strategy**.** Direct instruction is both a teaching model and a strategy that employs a behavioral approach to skill mastery that will lead a student to independence (Silver et al., 2007). The strategy consists of a four-phase framework that increases skill acquisition over time by utilizing modeling, direct practice, guided practice and independent practice. Direct instruction will help students focus on the process and build in multiple practice opportunities for students to make mistakes and correct mistakes made in the (Joyce et al., 2015; Silver et al.).

Self-Evaluation

Effective SRL is dependent on periodic self-evaluation of one's progress toward a set goal (Schunk, 2012). The SRL strategy of self-evaluation is comprised of two categories: self-judgement and self-reaction. The learner utilizes self-judgement to determine the current task placement status of the goal, and then self-reaction about the progress is made toward the set goal as noteworthy, satisfactory, unacceptable, and so on to determine what steps need to be taken to obtain the set goal (Schunk). This means the learner will monitor his/her progress toward a set goal and will determine through self-evaluation whether the progress being made is satisfactory. If the progress is acceptable, then the learner will continue on the learning path chosen to meet his/her set goal. However, if the progress is unacceptable, then the learner will utilize a different activity to get to the set goal. This is a continuous cycle. Schunk found that student achievement will increase when both self-regulated learning goal setting and self-evaluation strategies are combined

Mastery Learning Model

While the mastery teaching model (Carroll, 1963, 1989) assists in the planning and sequencing; this model increases the potential for more students to learn the concept by providing additional time, appropriate materials, and instruction (Joyce et al., 2015). The Mastery model is a system for designing self-instruction materials. Motivation and reinforcement are implemented in a systematic format that is utilized to lead students to discover concepts. The utilization of this model is essential for developers of computer software because the tasks are sequenced and the feedback is quick with clear objectives (Silver et al., 2007). This study expected students to utilize a computer-adaptive eLearning platform for homework; thus self- instructional allowed the students to work at their optimal level of productivity.

Graduated difficulty strategy**.** Graduated difficulty strategies actively engage students in working to achieve personal learning goals, which are leveled to meet each student's unique learning needs. This research-based strategy provides greater opportunities for each student to succeed, gain self-efficacy, and show improvement in the depth and quality of self-reflective capabilities, which are just a few of the benefits that may occur when this strategy is employed (Silver et al., 2007). In addition, the computer-adaptive homework format maintains this type of personalized instruction by adapting reading homework to each student's reading level. This computer-adaptive capability allows students to analyze and compare learning tasks to assess their learning performance and goal attainment.

Simple Collaborative Model

Cooperative tasks among intact groups support learning (Schunk, 2012). Combining social support and cognitive complexity caused by social interaction may cause motivational orientation to move from the external to the internal (Joyce et al., 2015). This happens because students become more interested in learning for its own sake instead of learning for external rewards. The simple collaborative model helps to develop a community of intrinsically motivated learners (Joyce et al.).

Reciprocal learning strategy**.** Reciprocal learning strategy is based on a social model that, when utilized, helps to establish a partnership among students. A peer partnership is formed to identify learning goals and to help each other reach the goals (Silver et al., 2007). For this teaching strategy, students think through their learning goals to determine if the goal has been met. Further, this is an effective model because it allows each student to provide feedback, praise, and suggestions; thus taking on different roles in the learning process (Silver et al.).

Self-Explanation

Self-explanation is the process of relating new information to prior knowledge. This strategy may take on many characteristics such as explaining how one solved a problem, showing how one should proceed to solve a problem, or explaining why a certain decision was made (Dunlowsky, 2013). Not as many research studies have been conducted on the self-regulated learning strategy of self-explanation, and there were no differences in the success rate of individuals who utilized this strategy compared to individuals who did not. However, the findings showed a positive effect in studies in which students who implemented this strategy had to solve new problems that required the transfer of previous knowledge. Dunlowsky attested that "one experiment's final test performance was three times better (about 90 percent versus 30 percent) for students who self-explain during practice than those who did not" (p. 18). It is due to this result that this strategy has shown a lot of promise (Dunlowsky).

One reason this strategy may promote learning and comprehension is that it encourages students to actively process content and transfer it to prior knowledge. The self-regulated learning strategy of self-explanation involves answering the why and how questions. The learner must take the time to develop and answer the question (Dunlowsky, 2013). In reading, self-explanation utilizes a question prompt that is most relevant to the text, for example, "What new information does the sentence provide, and how does it relate to what I already know?"

Nondirective Model

For the current study, the interpersonal teaching model was important because it fosters the students' need to relate and connect to self-learning. It allows the student to personally be involved and control the gains made in their learning (Silver et al., 2007). Utilizing this method helped the students establish a set of lifelong learning strategies that can be called on to not only solve academic problems, but real life problems (Joyce et al., 2015).

Decision-making strategy**.** The strategy decision-making provides students with a skill that may be transferred across curriculum areas. Furthermore, decision-making develops insight on how to make informed decisions that can be applied to all academic content areas and real life topics. Additionally, this strategy supports the students' ability to cite evidence, make judgements, and draw conclusions to justify their explanations of learning through active engagement (Silver, et al., 2007). Practice is important when implementing this strategy so good decision-making skills can fully develop into and assist in the realm of life.

Summary

The abovementioned treatment intervention strategies were adjusted to meet the criteria of this study to support the SRL being taught to the treatment intervention group during the implementation of a computer-adaptive homework platform. This investigation analyzed the data to determine if the outcomes reveal whether SRL strategies had an effect on student achievement.

CHAPTER 3

METHODOLOGY

Research has determined that homework has a positive effect on student achievement (Cooper, et al., 2006; Cooper & Valentine, 2001; Means et al., 2010; Trautwein, 2007); however, little research has considered how computer-based homework assignments affect student performance on computer-based assessments. This study sought to expand on the extant literature in two distinct ways. First, the researcher examined the extent to which computer adaptive homework affected students' scores on computerized-adaptive assessments. Second, this study posited that individual student differences (i.e., self-regulated learning) differentially influenced computer-adaptive assessment scores.

Chapter 3 outlines the research methodology, including a review of the research questions, description of the study sample, and a detailed explanation of the study measures and research design. Below are the research questions that provided the foundation for the present study.

Research Questions

This study was guided by three broad research questions, which were then used to derive the hypotheses.

1. Do students who use a computer-adaptive homework platform in conjunction with a self-regulated learning strategy treatment intervention perform better on the Measures

of Academic Progress than students who use only computer-adaptive homework or who receive no treatment intervention?

H1. Students who participate in computer-adaptive homework with a self-regulated students not using computer-adaptive homework or students using only computer-adaptive homework.

2. Do students who use only a computer-adaptive homework platform perform better on the Measures of Academic Progress than students who do not use a computer-adaptive homework platform?

   H2. Students who participate in computer-adaptive homework will perform better on the Measures of Academic Progress than the control group who did not receive the computer-adaptive homework or the learning strategy.

3. Do students' scores on the Motivated Strategies for Learning Questionnaire predict achievement scores for the Measures of Academic Progress, a computer-adaptive assessment?

   H3. Students' scores on the Motivated Strategies for Learning Questionnaire will predict students' achievement scores on the Measures of Academic Progress.

Research Design

This study implemented a pretest-posttest non-equivalent control group design as a means to compare student performance across the treatment intervention groups (Dimitrov & Rumrill, 2003). Pre- and posttest data collection occurred before and after the treatment intervention was applied, thereby allowing the researcher to measure and compare the degree of change related to the treatment intervention. The treatment interventions were applied to intact classrooms such that students were not randomly assigned to a given treatment intervention. However, the pretest-posttest non-equivalent control group design allowed the researcher to examine cause and effect relationships in the absence of random assignment (Dimitrov & Rumrill). This design yielded high external validity such that the treatment intervention was generalized either across the population, setting, or treatment variables. In addition, the pre- and posttest scores were compared within participants, which allowed the researcher to measure the degree of change that occurred after the treatment intervention was applied.

Treatment Interventions

Treatment interventions were applied to three fifth-grade classrooms during the fall of 2015.The timeline for this study was based on the prior year's (2014-2015) testing schedule, in which students completed the MAP assessment in September and January. In the first classroom, students utilized a computer-adaptive homework platform along with self-regulation learning strategies during the same nine-week period. The second classroom utilized only the computer adaptive homework platform for a period of nine weeks. The third classroom was not administered any treatment intervention, and thus served as the control group. In all three classes, students completed the MAP test at the beginning of the academic year (before any treatment interventions were applied) and after the treatment intervention was terminated. The SRL strategy treatment interventions are described in further detail in later sections.

Participants

Participants were recruited from three fifth-grade classes split across two elementary schools within a single school district in the Southwest suburbs of Chicago. The elementary schools are described in detail below and will be referred to as School One and School Two. Both schools are a part of the Elementary and Secondary Education Title I Act (Title I) passed in 1965. That is, federal funds provide financial assistance to the schools due to the high percentage of children from low-income families. This assistance is meant to ensure that children of low-socioeconomic status meet the state's academic standards (Illinois State Board of Education, 2014; U.S. Department of Education, 2014). Within School One, 68.1% of the population was categorized as low-income, while 1.7% of the students fell into the homeless category. Of the students who attended School Two, 69% were categorized as low-income, with 2% of the students reported as homeless. Both schools reported higher percentages of low-income students compared to the state average of 52% (Illinois State Board of Education).

School One was selected because it is one of the only elementary schools in the district that offers the entire student body a computer-adaptive eLearning homework platform; funding for this platform is a result of Title I allocations. Given that School One provides students with access to a computer-adaptive eLearning homework platform, this school housed the two classes who received the treatment intervention requiring use of computer-adaptive homework. Within School Two, the demographic composition and average student scores on standardized assessments were comparable to School One's, thus providing a control group.

At the end of the 2014-2015 school year participants were assigned to a fifth grade class by fourth grade teachers and school administrators. The fourth grade teachers, to the best of their ability, equally distributed the students by race, gender, academic ability, and behavior. Due to the pre-assignment of students to classes prior to the commencement of the current study, random assignment was not possible. In lieu of assigning students to classes, treatment intervention conditions were assigned to the three participating classes. The data for the participants' gender and racial/ethnic information were gathered from the district's admissions database. This information was provided by the parent at the time of student registration and admission into the school district. The three classes were comparable in terms of participants' gender, racial/ethnic identity, and socioeconomic status. Table 3.1 shows the gender of the participants in total, 58 students participated in this study.

Table 3.1

Participant Gender

Gender	Overall Percentage	Classroom One (N=19)	Classroom Two (N=22)	Classroom Three (N=17)
Male	47	47	50	44
Female	52	52	50	56

The racial/ethnic overall composition of the sample are as follows: 21.05% White, 35.08% Black, 35.08% Hispanic, and 8.77% multiracial. School One housed classrooms One and Two, which were the sites for the computer-adaptive eLearning homework platform only condition and the computer-adaptive eLearning homework platform and SRL strategies classroom condition, respectively. In Classroom One, there was a total of 19 participants, the racial/ethnic composition was 15.79 % White, 47.38% Black, 31.58% Hispanic, and 5.25 % Multiracial. Classroom Two consisted of a total of 22 participants, of which the racial/ethnic composition was 22.73% White, 27.27% Black, 36.36% Hispanic, and 13.64% multiracial. School Two housed Classroom Three, which was the site for the control group consisting of 17 participants. The racial/ethnic composition for Classroom Three was 25% White, 31.25% Black, 37.50% Hispanic and 6.25% multiracial. The three classes were comparable in terms of participants' gender, racial/ethnic identity, and socioeconomic status.

In addition to demographic similarity, the three classes also demonstrated comparable results on the Illinois Standardized Achievement test ([ISAT]; Illinois State Board of Education [ISBE], 2015a). Table 3.2 shows the 2013 test results reported by the state.

Table 3.2

2013 State Achievement Test Scores Grade 3-5

Grades 3rd-5th Reading	Building One Percentage	Building Two Percentage	State percentage
Met or Exceeded State Expectations	56	52	53

The initial PARCC scores for Spring 2015 assessment were reported as well as, the results of the overall performance expectations for reading achievement categories in the third through fifth grade students according to the ISBE (2015a, 2015b). Both schools had overall performance expectation scores similar to the state average for third through fifth grade level. Taken together, School One and School Two demonstrated similarities in both demographic composition and academic achievement scores, which provide support for the inclusion of both schools in the current study.

Table 3.3

2015 PARCC Test Scores Grades 3-5

Grades 3-5 Reading Expectations	Building One Percentage	Building Two Percentage	State percentage
Did not meet	10	17	14
Partially met	24	23	21
Approached	35	27	29
Met	30	32	31
Exceeded	2	1	4

Classroom Instruction

Within School One there were three regular education fifth-grade classes, two of which were single teacher classes and one co-taught class. The two single-teacher classes were selected as the classes to receive the treatment intervention conditions based on the availability of the computer-adaptive eLearning homework platform as well as similarity in the structure of the setting and instruction. In each of these classes, the teacher instructed approximately 25 students primarily through whole group instruction. The co-taught class was excluded from the study due to the distinctive factors in curriculum presentation and the student/teacher ratio of 1:12. School Two provided the class for the control condition and utilized an instruction method similar to School One.

In both Schools One and Two, fifth grade is the highest attainable grade level in the elementary building. At the end of the academic year, students transfer to a middle school environment to begin grade six. Students' scores on the computer-adaptive assessment determine the learning track placement of the students upon transferring to middle school. Both the learning and curricular options (e.g., challenge classes, remediation classes, band, career classes) are decided by the students' performance scores on the assessment; thus, the importance of these computer-adaptive assessment scores is highly emphasized by fifth-grade and middle school teachers.

Measures

<u>Motivated Strategies for Learning Questionnaire (MSLQ)</u>

All participants completed the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, 1991). The MSLQ is a common measure of students' beliefs about their use of both motivation and learning strategies and emphasizes the relationship among self-regulated learning, motivation, and achievement goals (Anthony et al., 2013). The measure consists of 81 self-report items answered on a 7-point Likert scale, where 1 = *not at all true of me* and 7 = *very true of me*. The measure is comprised of two distinct dimensions: motivation and learning strategies. Motivation is measured via 31 items. Example items from the motivation dimension include *"If I try hard enough, then I will understand the course material"* and *"Understanding the subject matter of this course is very important to me."*

The learning strategies dimension is measured via 50 items that address management of different resources (Pintrich, Smith, Garcia, & McKeachie, 1991, p. 5). Examples of learning strategies items include *"I usually study in a place where I can concentrate on my course work"* and *"I have a regular place set aside for studying."* The complete list of MSLQ items is presented in Appendix A. The MSLQ measure is structured such that both dimensions are comprised of subscales. In total, there are 15 subscales: six regarding the within the motivation dimension and nine within the learning strategies dimension. The questionnaire is modularly structured such that students can be administered separate subscales as well as all of the questions.

Questionnaire Scoring

To score the MSLQ, students' responses were summed to form a total MSLQ composite score, motivation strategies scale, and learning strategies scale. For example, the 31 items of the motivation strategy dimension were summed to create the motivation strategy scale. In addition, each of the 15 subscales was individually scored by summing the students' responses within each subscale. For example, the intrinsic goal orientation subscale is comprised of four items. Students' scores were calculated by summing these four items (Pintrich et al., 1991). This same procedure was used to form all of the subscales.

Reliability and Validity Evidence

Pintrich et al. (1993) conducted confirmatory factor analyses (CFA) for both the motivational items and learning strategy items to determine "the utility of the theoretical model and the operationalization of the MSLQ scales" (p. 805). The purpose of CFA is to identify and test the extent to which items load onto their respective factors. The results of this study showed that the items loaded properly onto their proposed factors, thereby suggesting that each dimension adequately measured what it was intended to measure. Although the complete presentation and discussion of CFA were beyond the scope of this investigation, results indicated that the MSLQ demonstrated validity evidence based on internal structure (see Pintrich et al., 1991, 1993). Further, the MSLQ evidenced predictive validity via correlations between subscale scores and students' final course grades (Pintrich et al., 1991). The correlations were statistically significant and moderate in strength, suggesting that scores on the MSLQ predicted to overall course grades.

The MSLQ is a self-report instrument initially designed to assess college students' motivational beliefs and utilization of different learning strategies for a college course (Pintrich et al., 1993). Since then the MSLQ has been proven to also predict student achievement at the elementary levels (Anthony et al., 2013; Barlia, 2014; Ocak & Yamac 2013; Orhan & Koskeroglu, 2009).

Yamac and Ocak (2013) concluded that there was a positive relationship between fifth grade motivational beliefs toward mathematics and mathematics achievement. Another study by Orhan and Koskeroglu (2009) investigated sixth, seventh, and eighth grade students' perception of task value for computer literacy course, which utilized the MSLQ. The findings of both studies supported the MSLQ survey as a valid and reliable instrument for elementary level students. Therefore, based on these findings, the current students utilized the MSLQ self-reporting survey to examine whether this instrument could predict achievement scores for the MAP, a computer-adaptive assessment.

Students in all three conditions completed the MSLQ pre-survey during the first week of October. The MSLQ survey was administered online via the Qualtrics platform during the students' regularly scheduled class time. The teacher read each question to the students in a whole group setting. Students' responses to the pre-survey and posttest MSLQ were timed. Student responses to the pre-survey took 25 minutes on average. Students' responses to the post-survey took 20 minutes on average. Students who missed the questionnaire sessions made up the sessions during the next available computer lab time slot.

Measure of Academic Progress

In accordance with district requirements, all students enrolled in Schools One and Two must complete the Measure of Academic Progress (MAP), a computer-adaptive assessment, at least twice per year. Students in all three conditions completed the first assessment in September 2015 prior to the administration of the treatment interventions. The scores on the first MAP assessment were used as the pretest. In January 2016, after completion of the treatment interventions, students completed a second MAP assessment, which provided the posttest scores. The MAP assessed students' proficiency levels in both English Language Arts (ELA) and mathematics as well as identified gaps in each student's learning via a responsive and dynamic testing format (NWEA, 2014, 2015). For the purpose of the present study, only the scores on the reading dimensions were used.

MAP test performance is described by a number called an RIT score, which has a range from 95 – 300. The scores are not specific to a grade level but are continuous, making it possible to use RIT scores to follow a student's educational growth from year to year. The ELA dimension of the MAP assessment included vocabulary as well as short passage and long passage formats, represented both fiction and nonfiction (NWEA, 2015), and consisted of 42 test items. The test items were pulled from an item test bank containing approximately 34,000 items. Therefore, students were not likely to experience repeated test items across the pre- and posttest sessions (NWEA).

Student status norms for the ELA dimension are presented in Table 3.4. For example, fifth grade students at the "begin-year" period had a mean ELA score of 205.70 and a standard deviation (SD) of 15.13. Because MAP scores are standardized on the normal distribution, approximately 68% of fifth grade students' ELA scores will fall between 190.57 and 220.83.

Table 3.4

Reading Student Status Norms

2015 READING Student Status Norms						
	Begin-Year		Mid-Year		End-Year	
Grade	Mean	SD	Mean	SD	Mean	SD
K	141.0	13.54	151.3	12.73	158.1	12.85
1	160.7	13.08	171.5	13.54	177.5	14.54
2	174.7	15.52	184.2	14.98	188.7	15.21
3	188.3	15.85	195.6	15.14	198.6	15.10
4	198.2	15.53	203.6	14.96	205.9	14.92
5	205.7	15.13	209.8	14.65	211.8	14.72
6	211.0	14.94	214.2	14.53	215.8	14.66
7	214.4	15.31	216.9	14.98	218.2	15.14
8	217.2	15.72	219.1	15.37	220.1	15.73
9	220.2	15.68	221.3	15.54	221.9	16.21
10	220.4	16.85	221.0	16.70	221.2	17.48
11	222.6	16.75	222.7	16.53	222.3	17.68

Student MAP reading ranges are presented in Table 3.5. These ranges indicate the MAP scores and the level of intervention to be applied to accommodate each of the individual learning needs.

Table 3.5

MAP Reading Range

		Probability of Level II	K[1]	1[1]	2	3	4	5	6
Reading or Language Usage	Fall	50 - 69%[2]	142-144	156-158	177-179	190-192	199-202	207-210	211-214
		70 - 89%	145-149	159-163	180-186	193-198	203-208	211-215	215-221
		≥ 90%[3]	150-157	164-173	187-196	199-210	209-218	216-225	222-230
	Winter	50 - 69%[2]	150-152	167-169	184-186	195-197	203-206	209-212	213-216
		70 - 89%	153-157	170-175	187-192	198-203	207-212	213-218	217-223
		≥ 90%[3]	158-166	176-185	193-203	204-214	213-222	219-228	224-232
	Spring	50 - 69%[2]	156-158	177-179	190-192	199-202	207-210	211-214	214-217
		70 - 89%	159-163	180-186	193-198	203-208	211-215	215-221	218-224
		≥ 90%[3]	164-173	187-196	199-210	209-218	216-225	222-230	225-234

Note: Fifth grade scores below the 50-69percentile (205-210) range may indicate a need for intervention to be sufficiently prepared for the next grade. Fifth grade scores above the ≥ 90 percentile (216-225) range indicate a high chance of meeting well prepared for the next grade.

Table 3.6 shows the NWEA RIT Scale Norms Study provided status and growth norms for individual students' RIT scales in Reading. The study's results are based on K-11 grade level samples. Each sample was comprised of 72,000 to 153,000 student test records from approximately 1,000 schools. These samples were randomly drawn from test record pools of up to 10.2 million students attending more than 23,500 public schools spread across 6,000 districts in 49 states. The NWEA used rigorous procedures to ensure that the norms were representative of the U.S. school-age population (NWEA, 2015).

Table 3.6

NWEA RIT Scale Norms for Beginning, Interim, and End Assessment

2015 READING Student Growth Norms						
	Begin-to-Mid Year		Mid-to-End Year		Begin-to-End Year	
Grade	Mean	SD	Mean	SD	Mean	SD
K	10.3	6.01	6.81	5.46	17.1	8.11
1	10.8	6.00	5.99	5.46	16.8	8.09
2	9.5	6.05	4.52	5.49	14.0	8.20
3	7.3	5.79	3.02	5.33	10.3	7.59
4	5.4	5.56	2.33	5.19	7.8	7.05
5	4.2	5.60	1.97	5.21	6.1	7.15
6	3.2	5.62	1.54	5.22	4.8	7.19
7	2.5	5.58	1.25	5.20	3.7	7.11
8	1.9	6.05	0.99	5.49	2.8	8.19
9	1.1	6.35	0.60	5.68	1.7	8.87
10	0.6	6.72	0.17	5.91	0.7	9.66

The NWEA RIT Scale Norms allow educators to compare achievement scores and the changes in growth between test occurrences regarding students' performance in the same grade at a comparable stage of the school year. These scores provide a basis for individualized instruction and student achievement goal setting.

<u>MAP Scoring</u>

Scoring of the MAP assessment is based on the item response theory (IRT). IRT estimates students' ability based on their performance on specific items representing a specific trait. A complete description of the role of IRT in the scoring of the MAP assessment is beyond the scope of this paper. In the case of the MAP, responses to test questions are explained by a single underlying ELA trait (Wang et al., 2013). The sequence of item administration to the students was adapted based on the students' performance on each item, resulting in a unique assessment experience for each student based on his or her ability. The obtained ELA scores reflect the ability level of each student on the ELA trait, which is represented by a single score. Thus, the interpretation of this score reflects the level of question difficulty a given student can answer correctly 50% of the time (NWEA, 2015).

Reliability and Validity Evidence

Researchers have examined the validity of both computer-adaptive tests (Shapiro & Gebhardt, 2012) and the MAP assessment (Wang et al., 2013). Previous research (Shapiro & Gephardt) has supported the validity of CAT in measuring students' academic performance. As for MAP, the seminal study by Wang et al. investigated the construct or factorial structure of a set of reading and mathematics assessments. The results showed that scores on both the mathematics and reading assessments were consistent (r = .90) across 10 states and all grade levels. That is, the results supported the MAP assessment as well-defined and proved to be unidimensional equivalent across grades, which suggested that each dimension adequately measured the construct it was purported to measure. Further, the ELA dimension demonstrated equivalent measurement across grades and academic years (Wang et al.).

Scootpad®

Classes One and Two utilized Scootpad®, a computer-adaptive eLearning platform, as part of the assigned treatment intervention. Students accessed ScootPad® outside of the classroom as part of their daily homework assignments. ScootPad® is modeled after the CCSS and allows students to practice concepts related to the standards that are later assessed via MAP. A detailed comparison of concept questions from the ScootPad® database and MAP's practice assessment questions are located in Appendix B. Presentation of the content is individualized based on students' performance on the learning units.

ScootPad® utilized a mastery teaching model (Joyce et al., 2015) that allowed students to practice reading concepts and skills in a game-like eLearning platform. Students participated in subject placement sessions that established a benchmark score and starting point for the initial eLearning activities. As the students interacted with the computer-adaptive system, the system individualized the sequence and complexity of the activity to fit each learner's needs. For example, in unit one of Scootpad, students were tested on five of the 42 CCSS concepts: use of comma to separate items in a series (L.5.2a), use of multiple sources to answer a question (R.I.5.7), use verb tense to convey time (L.5.1.c), use of context clues (L.5.4c), and use of context to self-correct (RF 5.4c). Only after the student received a score of 80% proficiency on the unit's concept could the student advance to the next unit. ScootPad® had 10 total units in ELA at the fifth grade level, and at the end of the 10 units, students completed a comprehensive unit that combined all 42 concepts previously presented (Kumar, 2014).

As students accurately responded to questions, the system rewarded the students with virtual coins. In turn, the students could use the coins to customize their individual platform or buy additional e-learning games. This reinforcement aimed to motivate students to set learning goals and monitor their progress. Figure 3.1 is a snapshot that illustrates some of the games that students could purchase with their virtual coins.

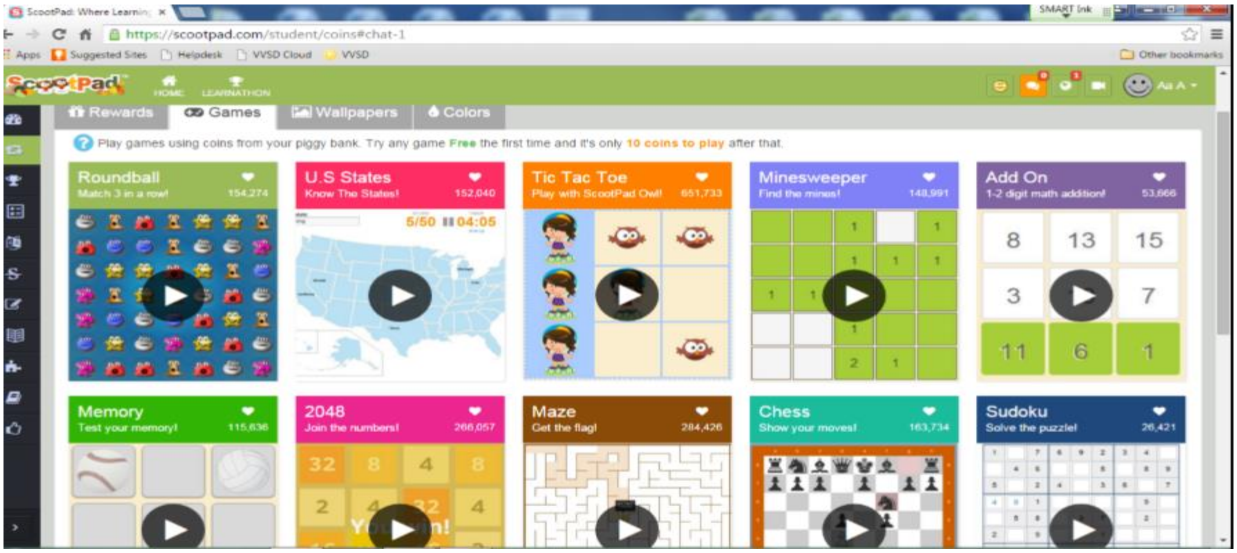

Figure 3.1: ScootPad® games and activities.

In addition to the games, Scootpad provided “Scootorials” for each CCSS if students struggled with a concept presented in the homework. The tutorial demonstrated the concept step-by-step, using both visual and auditory teaching methods. Students could revisit the “Scootorials” as many times as needed to master the concept. Once mastery was demonstrated, the system reassessed each student’s growth and adjusted the activity to meet the individual’s learning needs. Figure 3.2 illustrates the immediate feedback on the correctness of the response as the student completed each item.

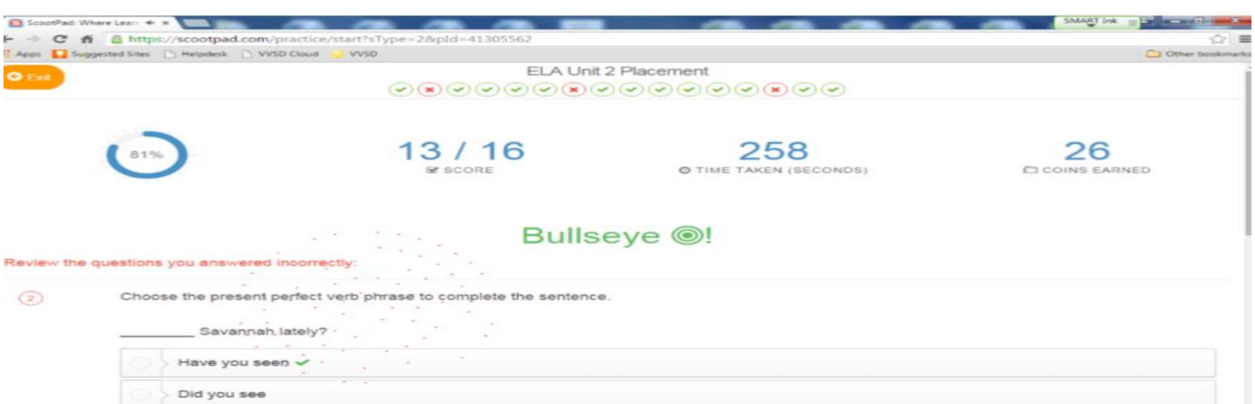

Figure 3.2. End of session feedback.

At the end of the session each student received a comprehensive item analysis along with the correct answers to missed items. Figure 3.2 illustrates the end of the session item analysis student feedback.

Procedures and Data Collection

The researcher obtained approval from the Institutional Review Board (IRB) before conducting any research. The researcher confirmed participation of the teachers in both buildings for the control group, the computer-adaptive homework group, and the computer-adaptive learning strategy group (see Appendix C). Before implementation of Scootpad®, the staff of School One participated in a half-day Scootpad professional development session that included the basic functions of the computer-adaptive learning platform.

Permission for the students to participate in the study was obtained by following Institutional Review Board protocol (Patten, 2011). Parents and students received student classroom placement at the Back-to-School-Day in August. Recruitment for the study took place during the fall parent/teacher conferences. Students were given a copy of the informed consent document that included the purpose of the study, the nature of students' participation in the study, the intended benefits and risks of participation in the study, and permission to use test data. Parents who did not want their child to participate in the study were asked to sign and return the signatory page (see Appendix D). Students who were allowed to participate in the study signed a letter of assent (see Appendix E). The school district granted the researcher permission through a written response (see Appendix F).

All Participants

The MAP assessment was administered to all students enrolled within the district in September 2015. The MAP posttest was administered in January 2016 immediately following students' return from first semester break.

Both the pre and post MSLQ surveys were administered orally to all students in the study by their respective classroom teacher. The pretest was administered at the beginning of the second quarter, and the posttest was administered at the end of the second quarter or nine weeks apart. In addition, by district mandate, each teacher conducted 120 minutes of reading instruction utilizing the District's reading curriculum, Benchmark Literacy. Procedures unique to each group are reviewed in the following sections.

Computer-Adaptive Homework Only Group Procedures

At the end of first quarter, Classes One and Two participated in a two-hour ScootPad® training session. During the session, students were given logins, passwords, and an introduction to the digital platform. In addition, students were encouraged to navigate and investigate the website. After successful completion of the training session, students completed ScootPad® ELA homework assignments Monday through Thursday, for a total of four days each week for nine weeks. Students could voluntarily access Scootpad material on Friday, Saturday, and Sunday, although this was not required.

Computer- Adaptive Homework and Self-Regulated Learning Strategies Group

Procedures

The students assigned to this condition completed the same ScootPad® training session as the computer-adaptive homework only group described above. On the first day of the study, the teacher provided each student with a three-ring binder that contained the weekly Scootpad Homework Worksheets (SPHWWS) and a reference section. Students were given worksheets that corresponded to each research week as well as the day of the week. That is, each page represented a day of homework. For example, SPHWWS 1.1 represented the first week and the first day of the week. Additional space was provided for students to write down their daily ScootPad® unit goal, to monitor their progress toward that goal, and to record topics of concern as they completed assignments. For example, the students recorded the original problem, their answer, and the correct answer for any mistakes made while working on Scootpad®. If students did not encounter problems in their ELA homework sessions, they chose a topic they believed would help the entire group as they progressed through the ScootPad® units.

In addition, each day the students considered how much time they would spend on ScootPad® that evening. Students then set a personal homework goal that was time- or unit-specific (e.g., 20 minutes or until unit level 4). Students recorded the specific goals on their daily worksheet and shared their goals with their peer partner.

Strategy Procedures

In addition to daily ScootPad® homework assignments, students in this condition also engaged in SRL strategies four times per week for nine weeks. The SRL strategies included direct instruction, reciprocal learning, graduated difficulty, and decision- making.

Direct instruction strategy**.** This strategy was used to facilitate goal setting and self-evaluation. The teacher modeled the procedure for recording mistakes encountered as students completed ScootPad® homework. Using 10 practice questions, the teacher purposely marked an incorrect answer for half of them. These errors were then discussed separately within a whole group setting. The teacher utilized questions to lead the students through a discussion to help them understand the steps necessary for completing the worksheet. Some example questions were "*Which question did I miss?*" and "*Can I determine why my answer was wrong?*"
On subsequent items, the students generated their own questions, while the teacher observed and provided feedback. Then the class reviewed individual responses through a whole group discussion. Lastly, the students worked through more examples independently. The students volunteered to share their questions with the group. This strategy was modeled and practiced every morning for the first three mornings.

Each day the teacher utilized a whole group direct instruction format that reviewed the homework topics. The topics were projected onto a classroom screen as they were written on a piece of loose-leaf paper. The students transferred the topic notes into the corresponding reference section. At the end of the session, students independently self-evaluated their understanding of the topic they had shared with the group. They answered the following questions with either a yes or no response: "*Do you understand your homework misconception?*" and "*Do you need additional help?*" This part of the activity took approximately 20 minutes.

Reciprocal learning strategy**.** This strategy allowed students to self-evaluate their academic performance through a collaborative learning peer partnership (Silver et al., 2007). This strategy is based on the simple collaborative teaching model, which has been supported to work well among an intact group (Joyce, et al., 2015, Zimmerman, 2000).

Forty minutes were set aside Tuesday through Friday at the beginning of the students' school day for students to engage in peer conversations. After the morning announcements, students sat in a circle in the back of the room, and a discussion leader was chosen to lead the ELA topic conversation; the teacher took notes during the meeting. The leader chose a student to discuss any ELA issue the student encountered while completing the previous night's ScootPad® homework. The student identified the unit from which the topic arose as well as the correct response to the missed item. This continued until all of the ELA topics were addressed.

At the end of the ELA topic session, the students met with their peer partner to discuss if their previous goal had been met and to establish the next day's homework goal. This discussion gave the students an opportunity to give and receive feedback from their partners. Most peer discussion sessions took 20 minutes. After the discussion session, the students went back to their desk to transfer discussed topics into the reference section of their three-ringed binder.

Graduated difficulty strategy**.** ScootPad® identified and individualized the learning levels based on the students' performance across learning units. As a result, the level of difficulty gradually increased as students progressed through the learning units. Students were provided immediate feedback on the completed unit concepts. Thus, unit level progression occurred until the students achieved mastery of the unit concepts. This type of support provided the appropriate materials, instruction, and additional time the student needed to master the concept (Joyce, et al., 2015; Silver et al., 2007).

Integration strategy**.** This strategy encouraged students to actively engage with and process the materials being focused on and integrate any prior concept knowledge to comprehend (Dunlowsky, 2013). At the end of each week, students who completed a learning unit during that week were asked to explain learned concepts and to connect prior knowledge related to those learned concepts. In the explanation, students went beyond paraphrasing and summarizing by connecting newly organized information with prior knowledge (Dunlowsky; Mayer, 1996).

Control Group

Instruction was delivered utilizing the direct instruction teaching model (Silver et al., 2007) for reading in whole group, small group, and individual one-on-one settings. Traditional reading homework was assigned throughout the week.

Data Analysis

Data are only as good as the instrument used to collect them and the research framework that guide the data collection (Pallant, 2010). To be useful, data collection instruments must be consistent; therefore, the current study utilized both survey responses and scores on the MAP standardized assessment as the means of data collection. The pre- and posttest MSLQ surveys were administered nine weeks apart and measured students' reported use of motivation and learning strategies. The pre- and post-MAP standardized assessments were administered four months apart and measured students' ELA ability. All of the data were analyzed utilizing the

SPSS Version 23 statistical software package. Table 3.7 illustrates the alignment of the research questions and hypothesis with the data analysis techniques.

Table 3.7

Alignment of Research Questions and Hypotheses with Data Analysis Techniques

	One-way analysis of covariance (ANCOVA)	Simple linear regression
Research Question 1 Do students who use a computer-adaptive homework platform in conjunction with a self-regulated learning strategy treatment interventions perform better on the Measures of Academic Progress than students who use only computer-adaptive homework or who receive no treatment intervention?		
H_1. Students who participate in computer-adaptive homework with a self-regulated learning strategy will perform better on the Measures of Academic Progress than students not using computer-adaptive homework or students using only computer-adaptive homework.	X	
Research Question 2 Do students who use only a computer-adaptive homework platform perform better on the Measures of Academic Progress than students who do not use a computer-adaptive homework platform?		
H_2. Students who participate in computer-adaptive homework will perform better on the Measures of Academic Progress than the control group who did not receive the computer-adaptive homework or the learning strategy treatment intervention.	X	
Research Question 3 Do student scores on the Motivated Strategies for Learning Questionnaire predict achievement scores for the Measures of Academic Progress, a computer-adaptive assessment?		
H_3 Student scores on the Motivated Strategies for Learning Questionnaire will predict students' achievement scores on the Measures of Academic Progress.		X

To address the first and second research questions, which posited that MAP posttest scores would vary based on treatment intervention condition, a one-way analysis of covariance (ANCOVA) was conducted. This analysis tested for statistical differences in MAP posttest scores as a function of the treatment intervention to which students were assigned. Pairwise comparisons derived from the ANCOVA were examined to compare means across the three treatment conditions.

To address the third research question, which posited that students' scores on the MSLQ would predict their scores on the post-MAP test, simple linear regression was used. This analysis tested whether or not scores on the MSLQ significantly predicted students' subsequent scores on the post-MAP assessment.

Descriptive and Inferential Statistics

For this study, the researcher analyzed mean, median, standard deviation, range, and minimum and maximum scores. The data obtained from the (MSLQ) survey scale were analyzed using descriptive and inferential statistics to determine if the MSLQ survey was able to predict the academic performance scores on the computer-adaptive Measures of Academic Progress (MAP) assessment. Further the data examined the relationship among the use of self-regulated learning strategies, student motivation, and the achievement goals (Anthony et al., 2013) among fifth grade students. The data accentuated the relationship between the students' common beliefs about motivation and learning strategies and performance scores. Descriptive and inferential statistics were used to organize and describe the characteristics of a collection of data and to use those characteristics to make inferences from a smaller group of data (Salkind, 2011).

Reliability Statistics

This study checked the Motivated Strategies for Learning Questionnaire (MSLQ) survey to determine the reliability of the scale when used with the sample. Cronbach's alpha coefficient is the most commonly used indicator of internal consistency and, therefore, was used in this study. This measure correlates the score for each item with the total score for each individual and then compares that to the variability present for all individual item scores. The ideal Cronbach alpha coefficient of a scale should be above .7 (Pallant, 2010). The higher the value, the more confident the researcher can be that the test measures, specifically, the sum of what each item was to evaluate (Salkind, 2011).

The MSLQ survey is based on a general cognitive view of motivation and learning strategies (Pintrich et al, 1991). The MSLQ consisted of 81 self-report items answered on a 7-point Likert scale, where 1 = *not at all true of me* and 7 = *very true of me*. There are two distinct parts to the survey, the motivation part, which consisted of 31 questions and assessed the fifth grade students' learning beliefs, goals, and test anxiety. The learning strategies part contained 19 questions that focused on the students' management of resources. The MSLQ measure is structured such that both parts are comprised of subscales. In total, there are 15 subscales: six regarding the within the motivation dimension and nine within the learning strategies dimension. The questionnaire is modularly structured such that students can be administered separate subscales as well as all of the questions.

To score the MSLQ, students' responses were summed to form a total MSLQ composite score, a motivation strategies scale, and a learning strategies scale. For example, the 31 items of the motivation strategy dimension were summed to create the motivation strategy scale. In addition, each of the 15 subscales was individually scored by summing the students' responses within each subscale. For example, the intrinsic goal orientation subscale is comprised of four items. Students' scores were calculated by summing these four items (Pintrich et al., 1991). This same procedure was used to form all of the subscales. The reliability of the scale can vary depending on the sample; therefore, it was important to measure the MSLQ survey scale for internal consistency.

Analysis of Variance (ANOVA)

An analysis of variance (ANOVA) was conducted to examine the extent to which significant differences existed in the means of the overall pretest scores across treatment conditions.

Analysis of Covariance (ANCOVA)

This study examined differences in MAP posttest composite scores by treatment condition; a one-way analysis of covariance (ANCOVA) was conducted. This statistical procedure equalized the initial differences between groups. ANCOVA allowed the researcher to explore differences between groups while statistically controlling for an additional variable (Pallant, 2010). The additional variable is called a covariate, which may be the variable that influences the scores on the dependent variable. By taking away the influence of the additional variable, ANCOVA increases the sensitivity in the tested outcome (Salkind, 2011). For example, the students' pretest MAP composite scores were used as a covariate in the analysis and allowed for examination of differences in students' posttest MAP composite scores while controlling for students' pretest MAP composite scores (Glass & Hopkins, 1996).

Paired-Sample *t*-Test

A paired-samples *t*-tests was conducted due to the pretest-posttest design (Pallant, 2010) to evaluate the impact of the treatment intervention on the students' scores. The study examined the differences between the MAP composite scores on the pretest, and the MAP composite scores on the posttest after the exposure to the treatment condition. This occurred to investigate if a difference in scores existed between the treatment intervention participants and the other participants that did not receive the treatment intervention.

Bonferroni Correction

This study applied a Bonferroni correction adjustment to the alpha level to set a more stringent alpha level for each item comparison. A Bonferonni correction was utilized, which adjusts alpha to .01 rather than .05, to minimize the possibility of committing a Type 1 error. For the correlations, $p<.01$ was reported because the correlations were significant at a value less than .01. Although .05 is the conventional cutoff, if a value is less than .01 or less than .001, it is presented as such rather than .05 (Pallant, 2010). In this study, because several pairwise comparisons were conducted at the same time, a Bonferroni correction was conducted on the comparisons. This allowed the analysis to control for Type I error when examining for pairwise differences among the treatment conditions (Salkind, 2011).

Simple Linear Regression

Linear regression is the most basic and commonly used predictive analysis. Regression estimates are utilized to describe data and to explain the relationship between one dependent variable and one or more independent variables (Pallant, 2010; Salkind, 2011). A regression line reflects the best prediction of the MAP performance scores based on responses from the MSLQ survey

Limitations

There are several factors that limited the ability to generalize the results of this study. First, only one computer-adaptive program, Scootpad®, was studied; thus, the results may be unique to this population of students using this particular software. Second, the study was implemented during the first semester of the school year. It is possible that a longer study duration could yield different results due to the increased exposure to the computer-adaptive homework platform. Further, fifth grade students experience a unique maturation period during the second semester, and this could have influenced scores between the first and second semesters. Another limitation may be any mismatch between Scootpad ® questions and MAP assessment questions, because of MAP's large test bank, it was not possible to acquire the test questions. Finally, the internal validity of this study may have been weakened because of the different teaching styles and teacher experience across the classes.

Summary

This study used a quantitative method approach to answer the research questions. The instruments used were an ELA pretest and posttest and the MSLQ survey taken by fifth grade elementary students. Results of these instruments were analyzed utilizing descriptive and correlational statistics. The next chapter in this study outlines the results of the data collection.

CHAPTER 4

RESULTS

Introduction

This chapter reports the results of the pretest-posttest non-randomized experimental design that examined the extent to which computer-adaptive homework and a self-regulated learning strategy affected students' achievement scores. First, a description of the participants in each research condition is provided. Next, analyses are presented that include descriptive statistics and correlations among the scores for the MAP and MSLQ (composite and subscales) for all students who participated. Finally, analyses are presented that address the three research questions.

Research Questions

This study was guided by three broad research questions, which were then used to derive the hypotheses.

1. Do students who use a computer-adaptive homework platform in conjunction with a self-regulated learning strategy treatment intervention perform better on the Measures of Academic Progress than students who use only computer-adaptive homework or who receive no treatment intervention?

   H1. Students who participate in computer-adaptive homework with a self-regulated students not using computer-adaptive homework or students using only computer-adaptive homework.

2. Do students who use only a computer-adaptive homework platform perform better on the Measures of Academic Progress than students who do not use a computer-adaptive homework platform?

   H2. Students who participate in computer-adaptive homework will perform better on the Measures of Academic Progress than the control group who did not receive the computer-adaptive homework or the learning strategy.

3. Do students' scores on the Motivated Strategies for Learning Questionnaire predict achievement scores for the Measures of Academic Progress, a computer-adaptive assessment?

   H3. Students' scores on the Motivated Strategies for Learning Questionnaire will predict students' achievement scores on the Measures of Academic Progress.

Participants

As described in Chapter 3, a total of 58 students across three groups completed the study. The treatment intervention was implemented for 45 school days from October to January. Students across all three groups completed a pretest and posttest for the MAP as well as the MSLQ. Table 4.1 illustrates the percentage rate for gender composition of the participations.

Table 4.1

Participant Gender

Gender	Overall Percentage	Classroom One (N=19)	Classroom Two (N=22)	Classroom Three (N=17)
Male	47	47	50	44
Female	52	52	50	56

The racial/ethnic overall composition of the sample are as follows: 21.05% White, 35.08% Black, 35.08% Hispanic, and 8.77% multiracial. School One housed classrooms One and Two, which were the sites for the computer-adaptive eLearning homework platform only condition and the computer-adaptive eLearning homework platform and SRL strategies classroom condition, respectively. In Classroom One, there was a total of 19 participants, the racial/ethnic composition was 15.79 % White, 47.38% Black, 31.58% Hispanic, and 5.25 % Multiracial. Classroom Two consisted of a total of 22 participants, of which the racial/ethnic composition was 22.73% White, 27.27% Black, 36.36% Hispanic, and 13.64% multiracial. School Two housed Classroom Three, which was the site for the control group consisting of 17 participants. The racial/ethnic composition for Classroom Three was 25% White, 31.25% Black, 37.50% Hispanic and 6.25% multiracial. The three classes were comparable in terms of participants' gender, racial/ethnic identity, and socioeconomic status.

Data Analyses by Research Question

All data were analyzed using IBM SPSS Statistics, Version 23. This section presents analyses for each of the research questions. Analyses will be presented first for the first and second research questions and then for the third research question.

Research Questions 1 and 2

The first and second research questions examined differences in MAP posttest scores based on the treatment intervention implemented in the study. The first research question asked: Do students who use a computer-adaptive homework platform with a self-regulated learning strategy treatment intervention perform better on the MAP than students not using any computer-adaptive homework or students using only computer-adaptive homework? The second research question asked: Do students who use a computer-adaptive homework learning platform only perform better on the MAP than students not using any computer-adaptive homework learning platform?

It was hypothesized that 1) students who participate in computer-adaptive homework learning platform with a self-regulated learning strategy treatment intervention would perform better on the MAP than students not using computer-adaptive homework learning platform or students using only computer-adaptive homework and 2) students who participate in computer-adaptive homework learning platform only would perform better on the MAP than the control group who did not receive the computer-adaptive homework learning platform or the learning strategy.

Previous information on norms, reading range, and grade level growth norms on the MAP assessments were presented in Chapter 3. Table 4.2 presents correlations among the pretest composite and domains scores on the MAP. Overall, MAP pretest scores were moderately to strongly correlate with each other (Mukaka, 2012). Scores on the literature domain, r (56) = .90, $p < .01$; informational domain, r (56) = .87; $p < .01$; and vocabulary domain, r (56) = .88, $p <$ .01, were significantly and strongly correlated with MAP composite scores. These results suggested that scores on each of the learning domains were significantly related to scores on the MAP composite score.

Table 4.2

Correlations among Pretest MAP Scores

Composite/Scale	1	2	3	4
1. MAP Composite	-			
2. MAP Literature Domain	.90**	-		
3. MAP Informational Domain	.87**	.66**	-	
4. MAP Vocabulary Domain	.88**	.71**	.63**	-

**p < .01.

Correlations among posttest scores on the MAP are presented in Table 4.3. Scores on the literature domain, r (56) = .84, $p < .01$; informational domain, r (56) = .86, $p < .01$; and vocabulary domain, r (56) = .82, $p < .01$, were again significantly and strongly correlated with MAP composite scores (Mukaka, 2012). These results again suggested that scores on each of the learning domains were significantly related to scores on the overall MAP composite score.

Table 4.3

Correlations among Posttest MAP Scores

Composite/Scale	1	2	3	4
1. MAP Composite	-			
2. MAP Literature Domain	.84**	-		
3. MAP Informational Domain	.86**	.63**	-	
4. MAP Vocabulary Domain	.82**	.53**	.54**	-

**p < .01.

Descriptive statistics, including the mean, median, standard deviation, range, and minimum and maximum scores, for pretest MAP composite and domain scores for all students participating in the study are presented in Table 4.4. Overall, the mean scores indicated that scores were similar across the MAP composite and three learning domains.

Table 4.4

Overall Descriptive Statistics for Pretest MAP Scores

Scale/Subscale	M	Mdn	SD	Range	Minimum-Maximum
MAP Composite	209.37	211.00	8.61	43.00	183.00-226.00
Literature Domain	209.73	211.00	10.39	47.00	182.00-229.00
Informational Domain	209.23	211.00	9.48	44.00	184.00-228.00
Vocabulary Domain	209.11	207.50	9.71	53.00	178.00-231.00

Note. *M* = mean, *Mdn* = median, *SD* = standard deviation. MAP scores below the 50-69percentile (205–210) range may indicate need for the intervention to be sufficiently prepared for the next grade. While scores above the ≥ 90percewntile (216-225) range indicate a high chance of meeting well prepared for the next grade.

Table 4.5 presents descriptive statistics for posttest MAP scores. As with the MAP scores on the pretest, scores on the posttest MAP composite and three domains were similar. Means for the MAP composite, literature domain, informational domain, and vocabulary domain scores increased from pretest to posttest. The MAP composite scores ranged from 182 to 234. To examine these differences, paired-samples *t*-tests were conducted. Because several *t*-tests were conducted simultaneously, a Bonferroni correction was performed to minimize the likelihood of committing Type I error (corrected $\alpha = .01$). The increase in students' composite scores from MAP pretest to MAP posttest was statistically significant after Bonferroni correction, t (56) = 4.71, $p < .01$, $d = 0.56$. Similarly, students' scores increased significantly on the literature domain, t (56) = 3.65, $p < .01$, $d = 0.47$; informational domain, t (56) = 3.92, $p < .01$, $d = 0.58$; and the vocabulary domain, t (56) = 3.90, $p < .01$, $d = 0.42$. These analyses suggested that, across the three treatment groups, students demonstrated significant gains in MAP composite as well as domain scores from pretest to posttest administration.

Table 4.5

Descriptive Statistics for Posttest MAP Scores

Scale/Subscale	M	Mdn	SD	Range	Minimum-Maximum
MAP Composite	213.95	214.50	8.33	52.00	182.00-234.00
Literature Domain	214.00	214.50	9.58	53.00	181.00-234.00
Informational Domain	214.71	214.50	9.81	55.00	184.00-239.00
Vocabulary Domain	212.83	213.00	10.05	62.00	180.00-242.00

Note. *M* = mean, *Mdn* = median, *SD* = standard deviation. MAP scores below the 50-69percentile (205–210) range may indicate need for the intervention to be sufficiently prepared for the next grade. While scores above the ≥ 90percewntile (216-225) range indicate a high chance of meeting well prepared for the next grade.

To address Research Questions 1 and 2, pairwise comparisons were used to evaluate the differences in MAP posttest composite scores between 1) students who used a computer-adaptive homework platform with a self-regulated learning strategy treatment intervention and students who did not use any computer-adaptive homework or students using only computer-adaptive homework and 2) students who used a computer-adaptive homework learning platform only and students who did not use any computer-adaptive homework learning platform. This allowed for examination of performance among students to address both research questions.

Further, descriptive statistics, including mean, median, standard deviation, range, and minimum and maximum scores, for MAP posttest scores by treatment condition are presented in Table 4.6. Given that the pretest scores were used in subsequent analyses as a covariate, it was necessary to ensure that pretest scores did not significantly vary by treatment condition. Thus, an analysis of variance (ANOVA) was conducted to examine the extent to which significant differences existed in the means of the overall pretest scores across treatment conditions. The results demonstrated that the pretest MAP scores did not vary significantly across treatment groups, F (2, 54) = 2.70, p > .05.

To address the first and second research questions and examine differences in MAP posttest composite scores by treatment condition, a one-way analysis of covariance (ANCOVA) was conducted. MAP composite scores were used as the dependent variable. The treatment condition to which students were assigned was used as the independent variable. Students' pretest MAP composite scores were used as a covariate in the analysis. This allowed for examination of differences in students' posttest MAP composite scores while controlling for students' pretest MAP composite scores (Glass & Hopkins, 1996).

Table 4.6

Descriptive Statistics for Pretest MAP Scores by Treatment Condition

Scale/Subscale	M	Mdn	SD	Range	Minimum-Maximum
MAP Composite					
CAH + SRL	211.00	211.50	4.83	18.00	202.00-220.00
CAH	205.74	206.00	9.69	43.00	183.00-226.00
Control	211.44	213.50	10.29	37.00	185.00-222.00
Literature Domain					
CAH + SRL	211.14	210.00	8.25	31.00	198.00-229.00
CAH	205.44	204.00	10.91	44.00	182.00-226.00
Control	212.63	212.50	11.48	42.00	186.00-228.00
Informational Domain					
CAH + SRL	210.77	211.00	7.19	31.00	197.00-228.00
CAH	205.89	204.50	10.44	40.00	188.00-228.00
Control	210.88	213.50	10.69	40.00	184.00-224.00
Vocabulary Domain					
CAH + SRL	210.86	207.00	7.75	31.00	200.00-231.00
CAH	205.61	204.50	10.62	47.00	178.00-225.00
Control	210.63	213.50	10.60	35.00	186.00-221.00

Note. Note. CAH + SRL = Computer-adaptive homework plus self-regulated learning strategy treatment intervention; CAH = computer-adaptive homework only .*M* = mean, *Mdn* = median, *SD* = standard deviation. MAP scores below the 50-69percentile (205–210) range may indicate need for the intervention to be sufficiently prepared for the next grade. While scores above the ≥ 90percewntile (216-225) range indicate a high chance of meeting well prepared for the next grade.

Table 4.7 shows the results of the ANCOVA, which indicate that students' posttest scores on the MAP did not differ significantly based on the treatment condition, F (2, 53) = 1.33, $p>.05$, $\eta_p^2 = .05$. To address Hypotheses 1 and 2, pairwise comparisons were examined next. Because several pairwise comparisons were conducted at the same time, a Bonferroni correction was conducted on the comparisons. This allowed the analysis to control for Type I error when examining for pairwise differences among the conditions (Salkind, 2011). Based on the analysis, students who participated in computer-adaptive homework with a self-regulated learning strategy treatment intervention (M = 214.64, SD = 8.01) did not perform significantly better on the MAP than students using computer-adaptive homework only (M = 213.84, SD = 7.53), $p > .05$ or students in the control group (M = 213.69, SD = 9.98), $p > .05$. Similarly, students who used computer-adaptive homework only did not perform significantly better than students in the control group, $p > .05$. Taken together, these results suggested that students' posttest MAP composite scores did not differ significantly based on whether they received computer-adaptive homework and a self-regulated learning strategy treatment intervention, computer-adaptive homework only, or neither. Thus, Hypotheses 1 and 2 are not supported.

Table 4.7

Descriptive Statistics for Posttest MAP Scores by Treatment Condition

Scale/Subscale	M	Mdn	SD	Range	Minimum-Maximum
MAP Composite					
CAH + SRL	214.64	214.00	8.01	33.00	201.00-234.00
CAH	213.84	216.00	7.53	27.00	200.00-227.00
Control	213.69	215.00	9.89	45.00	182.00-227.00
Literature Domain					
CAH + SRL	215.09	214.00	8.71	31.00	203.00-234.00
CAH	213.74	215.00	8.80	26.00	199.00-225.00
Control	212.88	215.00	11.73	50.00	181.00-231.00
Informational Domain					
CAH + SRL	216.09	215.00	10.12	39.00	200.00-239.00
CAH	214.05	215.00	9.36	35.00	199.00-234.00
Control	213.65	212.00	10.27	46.00	184.00-230.00
Vocabulary Domain					
CAH + SRL	212.77	213.00	9.71	44.00	187.00-231.00
CAH	213.16	212.00	10.53	48.00	194.00-242.00
Control	212.53	214.00	10.54	43.00	180.00-223.00

Note. CAH + SRL = Computer-adaptive homework plus self-regulated learning strategy treatment intervention; CAH = computer-adaptive homework only. *M* = mean, *Mdn* = median, *SD* = standard deviation. MAP scores below the 50-69 percentile (205–210) range may indicate need for intervention to be sufficiently prepared for the next grade. While scores above the ≥ 90 percentile (216-225) range indicate a high chance of meeting well prepared for the next grade.

<u>Research Question 3</u>

The third research question examined whether students' scores on the MSLQ predicted performance on the posttest MAP. The third research question asked: Do students' scores on the MSLQ predict achievement scores on the MAP? It was hypothesized that the students' scores on the posttest MSLQ would predict student performance outcomes on the MAP.

To address the third research question, simple linear regression was used. Students' scores on the post-survey administration of the MSLQ were used as the independent variable.

Students' posttest MAP scores were used as the dependent variable. The overall regression model was not significant: F (1, 53) = 1.04, p = .31, R^2 = .02. Scores on the MSLQ were not a significant predictor of student performance on the MAP: β = 0.02, 95% CI: [-0.02, 0.07], t (53) = 1.02, p > .05 and accounted for 2% of the variance in posttest MAP scores. The results suggested that students' reported use of motivation and learning strategies at post-survey, as measured by the MSLQ, was not a significant predictor of students' posttest composite scores on the MAP. Thus, Hypothesis 3 was not supported.

Correlations among the MSLQ composite and scale scores for the pre-survey administration of the MSLQ are presented in Table 4.8. Scores for the motivation strategies scale, r (56) = .87, p < .01, and the learning strategies scale, r (56) = .97, p < .01, of the MSLQ were significantly and strongly correlated with MSLQ composite scores. These results suggested that scores on each of the MSLQ scales were significantly related with scores on the MSLQ composite score.

Table 4.8

Correlations among Pre-Survey MSLQ Composite and Scale Scores

Composite/Scale	1	2	3
1. MSLQ Composite	-		
2. MSLQ Motivation Scale	.87**	-	
3. MSLQ Learning Strategies Scale	.97**	.74**	-

Note. MSLQ = Motivated Strategies for Learning Questionnaire. Correlations are Pearson Product-Moment Correlation Coefficients.
**p < .01.

Correlations among scores on the MSLQ composite, motivation scale, and learning strategies scale for the post-survey administration of the MSLQ are presented in Table 4.9. Scores for the motivation strategies scale, r (56) = .83, p < .01, and the learning strategies scale, r

(56) = .96, $p < .01$, of the MSLQ were significantly and strongly correlated with MSLQ composite scores. The results suggested that scores on each of the MSLQ scales were significantly related with scores on the MSLQ composite score. To determine the predictive validity, the MSLQ post-survey composite and scale scores were correlated with the posttest MAP scores.

Table 4.9

Correlations among Post-Survey MSLQ Composite and Scale Scores

Composite/Scale	1	2	3
1. MSLQ Composite	-		
2. MSLQ Motivation Scale	.83**	-	
3. MSLQ Learning Strategies Scale	.96**	.65**	-

Note. MSLQ = Motivated Strategies for Learning Questionnaire. Correlations are Pearson Product-Moment Correlation Coefficients.
**$p < .01$.

Table 4.10 presents descriptive and reliability statistics for the pre-survey administration of the MSLQ. Cronbach's alpha was used as an estimate of reliability for scores on the MSLQ composite, learning strategies scale, and motivation strategies scale. Overall, scores on the pre-survey administration of the MSLQ demonstrated adequate reliability (Nunnally, 1978). Students took an average of 25 minutes to complete the MSLQ during the pre-survey administration.

Table 4.10

Overall Descriptive and Reliability Statistics for Pre-Survey MSLQ Scale Scores

Scale/Subscale	M	Mdn	SD	Range	Number of items	α
MSLQ Composite	425.24	430.00	57.04	315.00	81	.94
Motivation Strategies Scale	172.19	174.00	18.87	120.00	31	.81
Learning Strategies Scales	253.05	258.09	41.64	204.00	50	.93

Note. MSLQ = Motivated Strategies for Learning Questionnaire. *M* = mean, *Mdn* = median, *SD* = standard deviation. Cronbach's alpha was used as an estimate of reliability.

Table 4.11 presents descriptive and reliability statistics for the post-survey administration of the MSLQ. Cronbach's alpha was again used as an estimate of reliability for scores on the MSLQ composite, learning strategies scale, and motivation strategies scale. Scores on the post-survey administration of the MSLQ also demonstrated adequate reliability (Nunnally, 1978). Students took an average of 21 minutes to complete the MSLQ during the post-survey administration.

Table 4.11

Descriptive and Reliability Statistics for Post-Survey MSLQ Scale Scores

Scale/Subscale	M	Mdn	SD	Range	Number of Items	α
MSLQ Composite	428.66	432.00	51.91	217.81	81	.94
Motivation Strategies Scale	172.46	175.00	18.79	76.00	31	.82
Learning Strategies Scales	256.21	259.00	37.72	154.33	50	.93

Note. MSLQ = Motivated Strategies for Learning Questionnaire. *M* = mean, *Mdn* = median, *SD* = standard deviation. Cronbach's alpha was used as an estimate of reliability.

Table 4.12 presents the descriptive statistics for the pre-survey MSLQ scale scores by treatment condition. Further, the table provides a comparison of the pretest MSLQ scores for the composite scores as well as the learning strategies scale and motivation strategies scale.

Table 4.12

Descriptive Statistics for Pre-Survey MSLQ Scale Scores by Treatment Condition

Scale/Subscale	M	Mdn	SD	Range
MSLQ Composite				
CAH + SRL	412.22	181.00	30.00	120.00
CAH	434.53	435.00	43.52	140.00
Control	431.02	457.00	79.31	315.00
Motivation Strategies Scale				
CAH + SRL	168.73	169.50	11.18	41.00
CAH	175.05	176.00	14.58	56.00
Control	173.33	181.00	30.00	120.00
Learning Strategies Scale				
CAH + SRL	243.50	248.00	34.57	148.00
CAH	259.47	256.19	33.80	128.00
Control	257.70	275.00	54.48	204.00

Table 4.13 presents the descriptive statistics for the post-survey MSLQ scores for each treatment condition. Further, the MSLQ scores are presented for the composite, motivation strategies scale, and learning strategies scale.

Table 4.13

Descriptive Statistics for Post-Survey MSLQ Scale Scores by Treatment Condition

Scale/Subscale	M	Mdn	SD	Range
MSLQ Composite				
CAH + SRL	424.83	431.29	44.35	165.92
CAH	418.35	423.00	54.27	178.00
Control	443.72	452.94	57.61	217.81
Motivation Strategies Scale				
CAH + SRL	170.10	170.00	18.04	73.00
CAH	174.92	179.00	17.28	61.00
Control	172.89	174.00	21.72	75.00
Learning Strategies Scale				
CAH + SRL	254.73	255.00	30.31	111.00
CAH	243.41	245.00	41.10	136.00
Control	270.83	273.00	39.51	154.33

Conclusions

The results suggest several important things about the goals of the study. Students' scores on the MAP increased significantly from pretest to posttest across treatment conditions. However, differences in posttest MAP composite scores based on treatment condition were not observed. Specifically, students who participated in computer-adaptive homework with a self-regulated learning strategy treatment intervention did not perform significantly better on the MAP than students using computer-adaptive homework only. Likewise, students who used computer-adaptive homework did not perform significantly better than students in the control group. Finally, scores on the MSLQ did not predict students' performance on the posttest MAP composite score. Potential explanations for these findings will be discussed in the next section.

CHAPTER 5

CONCLUSIONS

Summary

The current study expanded extant eLearning literature by examining the relationship between use of computer-adaptive eLearning homework and students' scores on a computer-adaptive assessment. In addition, it was posited that students' self-reported use of self-regulated learning strategies would predict achievement scores on the computer-adaptive standardized assessment. Overall, it was found that, across all research conditions, students experienced gains in their achievement scores from pretest to posttest. That is most of the students' scores had met MAP's projected growth scale for the posttest. However, there was no difference as the scores did not vary by condition. This chapter discusses the findings and implications as they pertain to the current study as well as recommendations and suggestions for future research.

Discussion of Findings

The current study utilized the adaptive learning model, since both the assessment and the eLearning homework platform formats were computer-adaptive programs. The adaptive learning model utilizes technology to create a computer program that generates practice and test items based on the student's response (Lee & Heyworth, 1997). This type of computer-adaptive capability personalizes the learning experience, and differentiates both instruction and testing to meet each student's individual learning needs (Lee & Heyworth; Leong, 2013; Mendicino, et al

2009). Previous studies have suggested that adaptive learning would enhance the learners' interaction by providing new and creative ways of motivating and engaging students of all abilities to attain their educational potential; thus increasing student academic performance scores (Jethro, Grace, & Thomas, 2012).

Additionally, the transfer-appropriate processing (TAP) theoretical framework was integrated into the current study. According to the TAP, student performance is improved when the context in which content is practiced matches the context in which content is assessed (Morris et al., 1997). The TAP theory would suggest that students who practiced learning concepts on the computer adaptive homework platform would perform better than those who did not use such a platform. The study used congruence between the computer-adaptive homework platform items and the computer-adaptive assessment.

Finally, the current study investigated self-regulation and the use of SRL strategies, which were goal setting, self-evaluation, and self-explanation. These strategies were used in conjunction with Scootpad®. Previous research has reported that when self-regulation and SRL strategies were implemented as a treatment intervention that student performance scores on traditional assessment formats were statistically significant (Schunk, 1996). Despite the similarities in the practice implemented in this study, students in the treatment intervention groups did not perform significantly better than students in the control group or the students who used only ScootPad® for homework.

In light of the insignificant findings of the current study, each theory provided a unique lens in which to view specific aspects of the study. These theories are embedded in and throughout the findings. It is the belief of the researcher that the insignificant outcomes provided an opportunity to build upon and gain insight into future teaching, learning and assessing possibilities for the 21st century classroom. The findings will be discussed and presented that address the three research questions.

Research Question 1

The first research question investigated the extent to which computer adaptive homework and SRL strategies were related to students' scores on a computer-adaptive assessment. Specifically, it was expected that students who utilized the homework platform in conjunction with SRL strategies would perform significantly better than students who utilized only the homework platform or who received no treatment intervention.

One possible explanation for the failure to find statistically significant differences among students' performance scores across research conditions may be attributed to the number of SRL strategies used and the implementation of the strategies. The implementation of more than one SRL strategy may have increased the students' cognitive load. Cognitive load is the task demands on one's memory (Park, 2013). If the increase in the tasks or cognitive load is too high, less learning can be expected (Eckhardt et al., 2012.) For example, in the current study, the students had to learn how to operate and navigate the computer system to complete ScootPad® assignments, and they also had to learn how and when to apply the three SRL strategies. These additional aspects of learning may have increased the students' cognitive load, thus resulting in lower performance scores.

One study conducted by Eckhardt et al. (2012) examined the relationship between instructional support and SRL strategies; the students' scores utilizing computer simulations resulted in findings similar to the current study. The students who had received both the instructional support strategy and the SRL strategy had a slight increase in their scores, but had the highest value of perceived cognitive load. The researchers suggested that the introduction to instructional support appeared only to be useful when implemented throughout different phases of the learning process (Eckhardt et al.). Consequently,

> to obtain optimal results, the right amount and the proper implementation of the SRL strategies must be used, because without the correct combination the cognitive load could be detrimental to student performance. That is, “too much” instructional support may result in constraints to knowledge acquisition and transfer when utilizing computer assessment systems. (p. 120)

Another possible explanation for the contradiction in the results of the current study’s findings may be due to the duration of the implementation of the SRL strategies. Many studies have supported significant differences in the students’ performance scores when both homework and SRL strategy interventions were examined (Bembenutty, 2011; Kitsantas & Zimmerman, 2009; Perels et al., 200). A study by Kitsantas and Zimmerman (2009) reported that self-regulated learners utilized SRL skills and approached homework in different ways than less skilled learners and also had higher academic performance scores. It is important to note that these findings were measured over the course of one semester. However, in a pretest-posttest study lasting nine-weeks, Perels and her colleagues examined the impact of SRL strategies on the mathematical achievement of sixth graders during mathematics instruction. The students who received the SRL strategy training showed improvement in their mathematical scores when the pretest-posttest were compared, but the scores were not statistically significant.

None of the abovementioned studies specifically identified the duration over which the strategy intervention was implemented and its relation to the results. However, Perels et al. (2009) mentioned the 9-weeks duration of the SRL strategies as a limitation in their study. The researchers noted that “greater effects regarding the learning behavior and the mathematical achievement should be expected in case of a continuous and fairly long-term instruction of self-regulation competencies in regular classes" (p. 28). With that in mind, the current study examined SRL strategies for half of a semester, which is nine weeks or 45 school days. The first day of the current study occurred in October, which was the first day of the second grading period. The students engaged in both the ScootPad® and SRL strategies for the entire quarter, which was four times per week for nine weeks. The study concluded in mid-December, the last day of the second grading period, which also marked the end of the first academic semester. The length of time the students participated in the computer-adaptive homework and/or the SRL strategies treatment intervention was approximately the same length of time as Perel et al.'s study, therefore the SRL strategies' 9-week span may be an explanation as to the reason for the study's findings. Consequently, the current study may have failed to capture the full development of SRL strategies, resulting in no significant difference between MAP performance scores between the groups.

Research Question 2

The second research question examined the differences in the MAP posttest composite scores for students in School One who utilized ScootPad® to complete their homework to the control group in School Two who did not utilize Scootpad®. The findings did not support Hypothesis 2. The findings of the current study showed that students who participated in either the computer-adaptive homework with an SRL strategy or in the computer-adaptive homework only group did not perform significantly better than students in the control group. Again these findings are contrary to the previous research.

The current study's findings can be compared to a similar study by Mendicino et al. (2009) that investigated the learning of fifth grade students under two homework conditions:

traditional paper and pencil and Web-based (digital) homework differed. Mendincio et al.'s findings showed that the effects of immediate feedback, one-to-one computing, and individualized scaffolding of learning concepts supported the individual learning needs of students and that the students learned significantly more from the web-based homework than traditional paper and pencil homework.

Similar to the treatment conditions of the current study, Mendicino et al. investigated fifth grade students' use of a computer-adaptive eLearning platform that provided immediate feedback on homework. However, there were several distinct differences between the two studies (i.e., definition and delivery management of the homework concepts, type of feedback and program advancement, assessment timing, and eLearning presentation). These distinctions may have resulted in the lack of the significant differences reported by the current study between the treatment groups MAP posttest scores.

One distinction may be tied to the definition of homework and the delivery management of the homework concepts. For example, the previous study's eLearning platform, ASSISTment, supported the daily mathematical curriculum or the concepts previously taught in the classroom by the teacher (Mendicino et al. 2009). This type of homework is known as practice homework; that is, the homework was an extension of the daily lesson in which the teacher presented the concept and then the students completed additional questions or problems related to the daily lesson's concept. The teacher manually adjusted the computer-adaptive program to align with the daily tasks presented within the curriculum. In Cooper's (1998) study, a distinction was made between same-day homework tasks and homework that included elements of preparation. Same-day homework tasks were less cognitively demanding because the items were repetitive. However, the other type of homework, preparation homework was defined as material that was not yet covered by the teacher and was found to have a greater cognitive load or be more cognitively demanding for the student (Cooper). The current study utilized preparation homework tasks, since the homework was not covered in class. ScootPad® utilizes the concepts from the rigorous CCSS that are encountered on the MAP assessment. That is, the students may or may not have encountered the concepts in the instructional curriculum or the classroom setting. Therefore, the students who utilized Scootpad ® may have experienced a more demanding cognitive load than the students completing the ASSISTment homework. Consequently, since the current study utilized an eLearning platform that presented more difficult homework, this may be one possible explanation for the difference in the results.

Another distinction may be in the way feedback was presented to the students. This, too, may have cause a discrepancy between the previous study and current findings. In Mendicino et al.'s 2009 study, the student had to answer the ASSISTment system questions correctly to move to a more difficult question/level. However, if the student responded incorrectly to a question, the system provided immediate feedback by using a scaffolding question, which broke the problem into specific steps. This system honed in on the student's misconception and required the student to complete specific steps accurately. Then the system had the student complete similar questions correctly. This continued until the student could complete similar problems without error (Mendicino et al.). The straightforwardness of the ASSISTment system's feedback, which utilized scaffolding questions, may be a factor in the study's statistically significant results.

Whereas, ScootPad® provided feedback only after the student had finished all of the questions in the unit. The ELA homework format was introduced throughout 10 units, covering four specific ELA standards at a time. When the students achieved 80% proficiency on the unit, then the eLearning platform advanced the student to the next unit. At the end of lesson, ScootPad® provided “Scoottorials” that reviewed any misconceptions. For example, a question may ask a student to write the given sentence in past perfect tense. If the student did not understand what word caused a sentence to be in the past perfect tense, the student could click on the “Scootorial” link and view an example of how to construct a sentence using the past perfect form. Another example of a misconception that a student might experience frequently was using commas in a series. Again if a student struggled with the concept, a quick click on the link at the end of the session took him or her to the lesson. This computer capability instantly met the learning needs of each individual student. It is important to note that these reviews were optional; therefore, the students had a choice as to whether to view the Scootorial. The difference between the way the systems required and directed student engagement in the incorrect responses may have caused the contrasts in the findings.

Yet another possibility may be the difference between concept practice and concept assessment. ASSISTment posttests were taken the day after the homework was completed (Mendicino et al., 2009). That is, if the students completed the computer-adaptive homework on day 1, the posttest was given on day 2, which calculates to approximately 24 hours between the homework concept practiced and the assessment. However, the current study’s posttest was given 45 school days after the initial ScootPad® homework assignment was given. In the current study, homework assignments were assigned by Scootpad®, which had the students practice concepts over an extended period. As the student achieved 80% proficiency on the concept, the system advanced the student to the next ELA concept. Furthermore, students did not review unit concepts until they had advanced through the entire 42 ELA concepts. At the completion of unit nine, students were placed into the “C unit,” or comprehensive level, where all 42 concepts were reviewed. The timing between the practice of a concept and the assessment of the concept may be another difference in the findings between Mendicino et al.'s, 2009 study and the current study.

The final difference between the two eLearning platforms was in the way they engaged the students. As described previously the ASSISTment was a straightforward tutoring system (Mendicino et al. 2009), whereas ScootPad® engaged students and promoted individualized learning through the use of gamification or a game-like way to promote learning. For instance, as students spent time on ScootPad® or advanced to the next unit level, the system rewarded the students with tokens to spend on learning-type games within the system (see Chapter 3 for examples of games that could be purchased with the tokens). Although most of the students spent time and progressed through the units, it is possible that the students did not approach the learning content seriously because of the gaming style that ScootPad® offered. While both eLearning platforms, ASSISTment and Scootpad®, were similar in adaptive learning structure, the way in which the systems delivered the components of the eLearning platform (i.e., the homework task load and the systems' ways of student advancement as well as the corrective feedback, student engagement, and the timing of the assessments) were different. Therefore, those differences may account for the lack of statistical significance in the current study's findings.

Research Question 3

Research question three in this study examined whether students' self-reported responses on the MSLQ predicted student performance scores on the MAP posttest composite scores. The current study's overall results did not find the students' responses on the MSLQ were a significant predictor of student performance on the MAP assessment. Although studies have supported the use of the MSLQ with elementary students (Eom & Reiser, 2000; Orhan & Koskeroglu, 2009), one possibility that may account for the lack of statistical significant in the current study was the lack of the students' comprehension of the MSLQ survey questions. For example, the findings by Anthony et al. (2013) supported a strong positive correlation across two subject domains that were in line with theoretical predictions. However, although these were positive findings, the researchers noted that the questions on the MSLQ may have been too abstract for the students. Anthony et al. suggested that the students' language was often based on simpler and less abstract words than were found on the MSLQ survey. Therefore, one possible explanation for the findings of the current study may be that although the teacher orally read the 81 questions to the students, the students in the study may not have completely understand the abstract words in one or more than one of the questions, and in turn, the students may not have responded accurately on the 7-point Likert scale.

Another, concern raised in a previous study with positive findings was the MSLQ self-reporting format may be subject to social desirability bias, that is, the students may have wanted to present themselves in a more favorable light and, therefore, were not completely honest in their responses (Duncan & McKeachie 2005). A couple of sample questions that may be looked upon as negative are "*I want to do well in fifth grade, because it is important to show my ability to my family, friends, or others"* or "*Even when fifth grade materials are dull and uninteresting, I manage to keep working until I finish."* That is, the students in the current study may have marked an answer that was different from their actual belief because they did not want to disclose a belief that may have been looked upon by the teacher as negative (Duncan & McKeachie).

Limitations

There are several considerations that may limit the generalizability of this study to other computer-adaptive eLearning platforms and the effects on elementary students' computer-adaptive assessments scores. The study was not a true experimental design.

The first limitation was the size of the sample, as a small sample size has a reduced chance of detecting a true effect and possibly weaken the statistical power of the study (Mertens 2015). Potentially the treatment intervention in this study had a limited probability of showing a significant difference in the effects among the small sample size and possibly skewing the effects of the treatment intervention.

Another limitation may have been the length of time during which the study was conducted. The study was implemented during the second quarter and lasted 45 school days or nine weeks. It is important to note that the students went on holiday break immediately following the end of the study. In addition to this factor, the timing of the posttest may have been a limitation. The MAP posttest was administered to the students the day after the students returned from the holiday break. The time between the completion of the treatment conditions and the posttest was two weeks, and during this time the students may have forgotten information that they may have retained if they had been tested immediately following the end of the semester. Thus, students may have performed better if there had not been a two-week gap between the completion of the treatment intervention and the posttest.

Another possible limitation may be any mismatch between ScootPad® questions and MAP assessment questions, because of MAP's large test bank, it was not possible to acquire the test questions.

To date no study has investigated the difference between tangible and intangible homework – that is, the student who has to physically turn in an assignment compared to a student who completes the digital form of homework, which is stored and can only be found in the computer system's homework database. The term may be "out of sight, out of mind." The 24/7 accessibility of ScootPad® allowed a student to work as long and as deeply as he or she had decided to go into the concept, but because it was a digital assignment with no tangible homework, that is no physical paper to complete or turn in, students may not have completed their assignments. Therefore, a student's inability to self-regulate or to utilize the SRL strategies needed to complete the homework assignments may have caused a negative impact on the students' performance scores. The digital way of being held accountable for completion of homework assignment was a significant aspect in this study because it required the students to complete the intangible digital assignments independently. Therefore, using the eLearning platform as homework may have added constraints and limited student performance.

Recommendations for Practice

Although across the three groups the results of this study showed the students' pretest scores increased when compared to their posttest scores, no statistically significant difference was found between the participants who utilized self-regulated learning strategy coupled with an eLearning homework platform, ScootPad®, when compared to the control group. Further the MSLQ was not predictive of the MAP posttest scores. Although most previous studies (Anthony et al., 2013: Eom & Reiser, 2000; Yamac & Ocak, 2013), did not focus on the impact that computer-adaptive eLearning homework platforms have on students' computer-adaptive assessment performance scores, their findings have suggested that homework positively impacted student performance scores and that the MSLQ survey is predictive of posttest scores. In light of the findings from this study as well as findings from previous research, there are several recommendations for practice that can be drawn from the results. They are as follows:

The findings of this study support the need to investigate ScootPad® as a resource that can be incorporated into students' school day. ScootPad® has characteristics similar to those observed in prior research studies and it has obtained statistically significant performance outcomes. ScootPad® provided students with individualized learning, immediate feedback, and a learning format that was congruent to their assessment; therefore, it is believed that an examination of scheduled practices would be beneficial for the students. The scheduled practice time would allow the students to utilize this eLearning platform within the constraints of the school day, and therefore, it would not only provide the students who have not fully developed the ability to self-regulate their behaviors to practice concepts on ScootPad®. All students would have the opportunity to experience the eLearning platform that individualizes learning while allowing the teacher to be the facilitator and guide the students as needed. This guidance may provide students with the support and examples needed to initiate self-regulated learning. This allotted time utilizing ScootPad® would allow students to experience individualized learning, which could positively impact the students' ability to transfer their learning without compromising their academic performance scores.

The findings of this study support the need to investigate the impact of cognitive load when utilizing computer-adaptive homework or computer-adaptive assessments. One possibility may be examination of the implementation of only one SRL strategy at a time. For example, the students may begin the year with the SRL strategy of goal setting, while a control group would not implement any strategy. The study could examine and measure the cognitive load on students who are digitally assessed compared to the students who did not use the SRL strategy. The process of intentionally adding more SRL strategies would be considered only as the students show achievement gains in their performance scores. This carefully implemented plan could help establish a cognitive load baseline for effective SRL strategies use.

The findings of this study support the need to investigate the impact of both practiced and prepared homework on digital assessment. One possible example may include the teacher's assignment of specific curriculum concepts taught in the classroom setting to be practiced on the eLearning platform system. ScootPad® would adapt the assigned concepts to meet the needs of the students. By adjusting the system, it would create a practice homework that may reduce the cognitive load on the student and, thereby, allow the students to transfer previously learned and practiced knowledge. This type of individualized learning may increase or positively impact the students' academic performance scores. Further investigation of the manner in which students utilize the feedback could help to determine whether "Scoottutorial" style of feedback is effective in increasing student achievement.

The research findings also support the examination of the way in which ScootPad® advances students to the next level of learning (Cooper, 2006). Determining an accurate percentage for movement (for example, examination of whether 80% proficiency is an appropriate percentage for unit advancement) may increase student performance scores.

Finally, the findings of this study support the need for further investigation into the word choice of the MSLQ. Studies have reported possible confusion and social desirability bias. An examination of the word choice within each question may provide insight into any possible misconceptions made by the students. The teacher can then utilize this information to help students make a more accurate decision about their true beliefs, which may help the MSLQ accurately predict digital assessment performance scores.

Recommendations for Future Research

Recommendations for future research were developed through examination of concerns discovered during the study. First future research could replicate this study but utilize a mixed method or qualitative design. By changing the design method, the investigation could answer questions a quantitative study cannot answer. For example, why students did not complete their homework or what aspects of the computer-adaptive platform did the students believe helped them to transfer their knowledge onto the computer-adaptive assessment?

Another further, this study could be replicated and conducted in other grade levels. Utilizing a different study design or incorporating different grade levels would expand knowledge and inform educational leaders about what helps student acquire and transfer knowledge in the realm of digital assessment.

In addition, future research could include an investigation into other eLearning platforms. An examination into the differences between the use of practice-homework versus preparation-homework on computer-adaptive performance scores when utilizing an eLearning homework platform. The results of this investigation could provide educators with empirical evidence as to which type of homework would be more beneficial and more likely to increase the students' computer-adaptive performance scores.

Similarly, future research could investigate the eLearning platform system's feedback to determine whether students who work through specific steps to advance in the system will have greater success or if the end-of-session feedback will have a greater impact on students' performance scores. The conclusions drawn from these investigations could drive instructional practices of future educators.

Finally, future study could be conducted by modifying the length of the treatment time and/or the amount of time between the completion of the treatment and the assessment. This would help to determine if utilizing the eLearning platform could have statistically significant findings by implementing either a longer strategy treatment intervention window or a shorter assessment window.

Conclusion

Today, teachers are faced with the challenge of supporting student learning in the wake of the recently adopted rigorous CCSS, the implementation of a new generation of digital assessments, and the execution of PERA. Together these factors require the teacher to not only support student learning but to provide evidence of learning growth in students' academic performance scores. With so many options for teachers to choose from, it has been particularly challenging to distinguish the qualities among the eLearning platform resources. An effective eLearning platform system must be able to individualize student learning and increase academic performance scores on the digital assessments. Although the eLearning platform in this study did not show significant findings among the groups, the analysis provides an initial step in the right direction.

The findings in this study suggest the need for additional research and investigation into the eLearning platforms and strategy. Future studies could provide useful resources that support individualized learning while increasing student performance scores, which in turn may help the teachers and students both in and outside the classroom.

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APPENDIX A

MSLQ QUESTIONS PARTS A AND B

MSLQ Item List

The following is a list of items that make up the MSLQ (from Pintrich et al., 1991).

Part A. Motivation

The following questions ask about your motivation for and attitudes about this class. Remember there are no right or wrong answers, just answer as accurately as possible. Use the scale below to answer the questions. If you think the statement is very true of you, circle 7; if a statement is not at all true of you, circle 1. If the statement is more or less true of you, find the number between 1 and 7 that best describes you.

1. In fifth grade, I prefer class material that really challenges me so I can learn new things.
1 2 3 4 5 6 7
Not at all Very true of me

---

2. If I study in appropriate ways, then I will be able to learn the material in fifth grade.
1 2 3 4 5 6 7
Not at all Very true of me

---

3. When I take a test I think about how poorly I am doing compared with other students.
1 2 3 4 5 6 7
Not at all Very true of me

---

4. I think I will be able to use what I learn in fifth grade in other grades.
1 2 3 4 5 6 7
Not at all Very true of me

---

5. I believe I will receive an excellent grade in fifth grade.
1 2 3 4 5 6 7
Not at all Very true of me

---

6. I'm certain I can understand the most difficult material presented in the readings for fifth grade.
1 2 3 4 5 6 7
Not at all Very true of me

---

7. Getting a good grade in fifth grade is the most satisfying thing for me right now.
1 2 3 4 5 6 7
Not at all Very true of me

---

8. When I take a test I think about items on other parts of the test I can't answer.
1 2 3 4 5 6 7
Not at all Very true of me

---

9. It is my own fault if I don't learn the material in fifth grade
1 2 3 4 5 6 7
Not at all Very true of me

10. It is important for me to learn the fifth grade material in this class.
1 2 3 4 5 6 7
Not at all Very true of me

---

11. Most important thing for me right now is improving my overall grade point average, so my main concern in fifth grade is getting a good grade.
1 2 3 4 5 6 7
Not at all Very true of me

---

12. I'm confident I can learn the basic concepts taught in fifth grade.
1 2 3 4 5 6 7
Not at all Very true of me

---

13. If I can, I want to get better grades in fifth grade than most of the other students.
1 2 3 4 5 6 7
Not at all Very true of me

---

14. When I take tests I think of the consequences of failing.
1 2 3 4 5 6 7
Not at all Very true of me

---

15. I'm confident I can understand the most complex material presented by the instructor in fifth grade.
1 2 3 4 5 6 7
Not at all Very true of me

---

16. In fifth grade, I prefer course material that arouses my curiosity, even if it is difficult to learn.
1 2 3 4 5 6 7
Not at all Very true of me

---

17. I am very interested in the content area of fifth grade.
1 2 3 4 5 6 7
Not at all Very true of me

---

18. If I try hard enough, then I will understand fifth grade material.
1 2 3 4 5 6 7
Not at all Very true of me

---

19. I have an uneasy, upset feeling when I take an exam.
1 2 3 4 5 6 7
Not at all Very true of me

---

20. I'm confident I can do an excellent job on the assignments and tests in fifth grade.
1 2 3 4 5 6 7
Not at all Very true of me

---

21. I expect to do well in this class.
1 2 3 4 5 6 7
Not at all Very true of me

22. Most satisfying thing for me in fifth grade is trying to understand the content as thoroughly as possible.

1	2	3	4	5	6	7
Not at all					Very true of me	

---

23. I think the fifth in this class is useful for me to learn.

1	2	3	4	5	6	7
Not at all					Very true of me	

---

24. When I have the opportunity in fifth grade, I choose class assignments that I can learn from even if they don't guarantee a good grade.

1	2	3	4	5	6	7
Not at all					Very true of me	

---

25. If I don't understand the fifth grade material, it is because I didn't try hard enough.

1	2	3	4	5	6	7
Not at all					Very true of me	

---

26. I like the subject matter in fifth grade.

1	2	3	4	5	6	7
Not at all					Very true of me	

---

27. Understanding the subject matter in fifth grade is very important to me.

1	2	3	4	5	6	7
Not at all					Very true of me	

---

28. I feel my heart beating fast when I take an exam.

1	2	3	4	5	6	7
Not at all					Very true of me	

---

29. I'm certain I can master the skills being taught in fifth grade.

1	2	3	4	5	6	7
Not at all					Very true of me	

---

30. I want to do well in fifth grade, because it is important to show my ability to my family, friends, or others.

1	2	3	4	5	6	7
Not at all					Very true of me	

---

31. Considering the difficulty of fifth grade, the teacher, and my skills, I think I will do well in this class.

1	2	3	4	5	6	7
Not at all					Very true of me	

Part B. Learning Strategies

The following questions ask about your learning strategies and study skills for this class. Again, there are no right or wrong answers. Answer the questions about how you study in this class as accurately as possible. Use the same scale to answer the remaining questions. If you think the statement is very true of you, circle 7; if a statement is not at all true of you, circle 1. If the statement is more or less true of you, find the number between 1 and 7 that best describes you.

32. When I study the readings for fifth grade, I outline the material to help me organize my thoughts.
1 2 3 4 5 6 7
Not at all Very true of me

---

33. During class time I often miss important points because I'm thinking of other things. (RC)
1 2 3 4 5 6 7
Not at all Very true of me

---

34. When studying for this fifth I often try to explain the material to a classmate or friend.
1 2 3 4 5 6 7
Not at all Very true of me

---

35. I usually study in a place where I can concentrate on my class work.
1 2 3 4 5 6 7
Not at all Very true of me

---

36. When reading for fifth grade, I make up questions to help focus my reading.
1 2 3 4 5 6 7
Not at all Very true of me

---

37. I often feel so lazy or bored when I study for fifth grade that I quit before I finish what I planned to do. RC)
1 2 3 4 5 6 7
Not at all Very true of me

---

38. I often find myself questioning things I hear or read in fifth grade to decide if I find them convincing.
1 2 3 4 5 6 7
Not at all Very true of me

---

39. When I study for fifth grade, I practice saying the material to myself over and over.
1 2 3 4 5 6 7
Not at all Very true of me

---

40. Even if I have trouble learning the material in fifth grade, I try to do the work on my own, without help from anyone. (RC)
1 2 3 4 5 6 7
Not at all Very true of me

---

41. When I become confused about something I'm reading for fifth grade, I go back and try to figure it out.
1 2 3 4 5 6 7
Not at all Very true of me

---

42. When I study for fifth grade, I go through the readings and my class notes and try to find the most important ideas.
1 2 3 4 5 6 7
Not at all Very true of me

---

43. I make good use of my study time for fifth grade.
1 2 3 4 5 6 7
Not at all Very true of me

---

44. If fifth grade readings are difficult to understand, I change the way I read the material.
1 2 3 4 5 6 7
Not at all Very true of me

---

45. I try to work with other students from fifth grade to complete the class assignments.
1 2 3 4 5 6 7
Not at all Very true of me

---

46. When studying for fifth grade, I read my class notes and the class readings over and over again.
1 2 3 4 5 6 7
Not at all Very true of me

---

47. When an idea, interpretation, or conclusion is presented in fifth grade or in the readings, I try to decide if there is good supporting evidence.
1 2 3 4 5 6 7
Not at all Very true of me

---

48. I work hard to do well in fifth grade even if I don't like what we are doing.
1 2 3 4 5 6 7
Not at all Very true of me

---

49. I make simple charts, diagrams, or tables to help me organize class material.
1 2 3 4 5 6 7
Not at all Very true of me

---

50. When studying for fifth grade, I often set aside time to discuss class material with a group of students from the class.
1 2 3 4 5 6 7
Not at all Very true of me

---

51. I treat the fifth grade as a starting point and try to develop my own ideas about it.
1 2 3 4 5 6 7
Not at all Very true of me

---

52. I find it hard to stick to a study schedule. (RC)
1 2 3 4 5 6 7
Not at all Very true of me

53. When I study for fifth grade, I pull together information from different sources, such as lectures, readings, and discussions.
1 2 3 4 5 6 7
Not at all Very true of me

54. Before I study new fifth grade material thoroughly, I often skim it to see how it is organized.
1 2 3 4 5 6 7
Not at all Very true of me

55. I ask myself questions to make sure I understand the material I have been studying in fifth grade.
1 2 3 4 5 6 7
Not at all Very true of me

56. I try to change the way I study in order to fit fifth grade requirements and the instructor's teaching style.
1 2 3 4 5 6 7
Not at all Very true of me

57. I often find that I have been reading for fifth grade but don't know what it was all about. (RC)
11 2 3 4 5 6 7
Not at all Very true of me

58. I ask the teacher to clarify concepts I don't understand well.
1 2 3 4 5 6 7
Not at all Very true of me

59. I memorize key words to remind me of important concepts in fifth grade
1 2 3 4 5 6 7
Not at all Very true of me

60. When class work is difficult, I either give up or only study the easy parts. (RQ)
1 2 3 4 5 6 7
Not at all Very true of me

61. I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying for this course.
1 2 3 4 5 6 7
Not at all Very true of me

62. I try to relate ideas in fifth grade subjects to those in other courses whenever possible.
1 2 3 4 5 6 7
Not at all Very true of me

63. When I study for fifth grade, I go over my class notes and make an outline of important concepts.
1 2 3 4 5 6 7
Not at all Very true of me

64. When reading for fifth grade, I try to relate the material to what I already know.
1 2 3 4 5 6 7
Not at all Very true of me

---

65. I have a regular place set aside for studying.
1 2 3 4 5 6 7
Not at all Very true of me

---

66. I try to play around with ideas of my own related to what I am learning in fifth grade.
1 2 3 4 5 6 7
Not at all Very true of me

---

67. When I study for fifth grade, I write brief summaries of the main ideas from the readings and my class notes.
1 2 3 4 5 6 7
Not at all Very true of me

---

68. When I can't understand the material in fifth grade, I ask another student in this class for help.
1 2 3 4 5 6 7
Not at all Very true of me

---

69. I try to understand the material in fifth grade by making connections between the readings and the concepts from the lectures.
1 2 3 4 5 6 7
Not at all Very true of me

---

70. I make sure that I keep up with the weekly readings and assignments for fifth grade.
1 2 3 4 5 6 7
Not at all Very true of me

---

71. Whenever I read or hear an assertion or conclusion in fifth grade, I think about possible alternatives.
1 2 3 4 5 6 7
Not at all Very true of me

---

72. I make lists of important items for this fifth grades and memorize the lists.
1 2 3 4 5 6 7
Not at all Very true of me

---

73. I attend this class regularly.
1 2 3 4 5 6 7
Not at all Very true of me

---

74. Even when fifth grade materials are dull and uninteresting, I manage to keep working until I finish.
1 2 3 4 5 6 7
Not at all Very true of me

---

75. I try to identify students in fifth grade whom I can ask for help if necessary.
1 2 3 4 5 6 7
Not at all Very true of me

76. When studying for fifth grade I try to determine which concepts I don't understand well.
1 2 3 4 5 6 7
Not at all Very true of me

---

77. I often find that I don't spend very much time on fifth grade materials because of other activities. (RC)
1 2 3 4 5 6 7
Not at all Very true of me

---

78. When I study for fifth grade, I set goals for myself in order to direct my activities in each study period.
1 2 3 4 5 6 7
Not at all Very true of me

---

79. If I get confused taking notes in fifth grade, I make sure I sort it out afterwards.
1 2 3 4 5 6 7
Not at all Very true of me

---

80. I rarely find time to review my notes or readings before an exam. (RC)
1 2 3 4 5 6 7
Not at all Very true of me

---

81. I try to apply ideas from fifth grade readings in other class activities such as lecture and discussion.
1 2 3 4 5 6 7
Not at all Very true of me

APPENDIX B

MAP AND SCOOTPAD® COMPARISON

Sample MAP® Test: MAP Reading

Drag the correct meaning for each prefix into the chart.

Prefix	Definition
non-	________
re-	________

before again not with

ScootPad® Unit 3

Identify the prefix in the word *foremost*.

The affix "mis" means

- able
- not
- with
- one

Sample MAP® Test: MAP Reading

Read the passage.

Narrator: As the sun rises on our small town, Jamal begins his paper route.

Jamal (as he throws his newspaper): Good morning, Mrs. Ortiz!

This passage is an example of which type of text?

1. a play
2. a poem
3. an essay

ScootPad Unit 4

How do you format the following play?

42nd Street

- Put quotation marks around it
- Underline it ✔
- Bold it

Sample MAP® Test: MAP Reading

Read the paragraph.

If you are ever looking for something new to do, play a game called "Silly Stories." First, get some paper, scissors, paste, and old magazines. Next, cut different words out of the old magazines. Some of the words should be about people or things. Other words should be action words. Then put the words together in funny ways—for example, "Puppy drives banana car." Paste the words on a piece of paper, and write a short story to go with them. Have fun reading your silly stories to your families and friends!

How does the writer arrange the ideas in the paragraph?

1. by explaining the cause and effect of events
2. by telling how things are the same or different
3. by putting events in time order to tell what happens
4. by showing the difference between facts and opinions

ScootPad® Unit 5

All of the following show <u>sequence</u> except

- ○ lastly
- ✔ yet
- ○ then
- ○ after

Sample MAP® Test: MAP Reading

Read the passage.

It is important to help people. It is easy to think of yourself, but you should think about others, too. One place to help others is at school. If there is a new student, show him around the playground. You can also help your teacher by passing out papers or cleaning up messes. Helping others will also make you feel good. It will show people you care.

Drag the answer that tells the author's most important idea into the column marked "Idea." Then, drag two sentences that tell you why the author thinks this into the column marked "Why."

Idea	Why
1.	1.
	2.

Many schools have playgrounds.

It is important to help others.

You feel good when you help others.

Helping will show people you care.

You should always listen to your family.

Sometimes there are new kids at school.

ScootPad® Unit 6

Passage #1 by Maggie Cleary

You probably will not get a better education overseas. American universities are pretty phenomenal. People come from all over the world to go to school in the United States. At the end of the day, universities are meant to provide you with the best scholarly education — and you won't find anyplace better than the good old US of A.

It's expensive. Sure, universities in the U.S. cost a lot of money. Although universities abroad don't charge nearly as much tuition as American schools, most universities still force students to pay regular tuition for a semester in addition to paying for long flights and expensive city life.

One of the biggest reasons students cite for going abroad is "stepping out of his/her comfort zone." But it seems that they neglect that its completely possible to step out of their culture zone while in college. Evidently, when you travel, you experience new cultures and new people — but most of the time new cultures and experiences are just a dorm room away.

Now is not the only time in your life you can travel or live abroad. Most often, students will cite study abroad as a once in a lifetime opportunity — the only time in their existence they can live abroad. This is certainly not the case.

Even though you may be having a great time, you only get four years at college. Students will try to stay in touch, but it's hard. Back in College World, life goes on without you.

Passage #2 from St. John's University

Enhance your intellectual and personal journey, expand your mind, broaden your horizons and gain a new perspective on life. Learn to think and act globally.

Being abroad gives you the opportunity to discover your strengths and abilities, conquer new challenges, and solve new problems. Learn why the Spanish steps are in Rome! See the beauty of Monet's Giverny gardens for yourself! Trace the footsteps of Spanish culture in Seville!

Learning a language in New York means visiting the Language Lab, but when you study abroad, the language lab is all around you! Give your language skills such a boost that you'll soon sound like a native speaker.

As global citizens we must find ways to serve not only those in our own communities, but also those in need throughout the world. You will have the chance to go beyond your nation's boundaries and help families right in their own country. Students who have worked in soup kitchens in Rome or hospitals in Paris have gained a new perspective on other cultures and people.

Studying abroad is an investment in your future - one that helps distinguish you from the crowd.

Hide Passage

The overall structure of both passages **combined** is

Sample MAP® Test: MAP Reading

Read the passage.

The White-crowned Sparrow

1 Sparrows are small, common birds. They live in most parts of North America. There are many kinds of sparrows. These birds live in many different places, or habitats. Sparrows can live in the city or the country. The white-crowned sparrow is one kind of sparrow.

What They Look Like

2 The white-crowned sparrows look like they are plain gray from far away. However, these birds actually have black and white stripes on their heads. They also have small, pale pink or yellow bills. Their chests are pale gray, and they have white bars on their wings. Their backs are soft brown, and they have long tails.

Where They Live

3 White-crowned sparrows live in brushy areas. They prefer woodlands and thickets, which are areas with lots of trees and bushes. They use the nearby open areas to look for food.

What They Eat

4 White-crowned sparrows eat many kinds of seeds, including sunflower seeds. They like grasses and grains, too. They also like blackberries. Sometimes these birds will make short flights to catch an insect to eat.

How They Nest and Raise Their Young

Which sentence from the passage is an opinion about white-crowned sparrows?

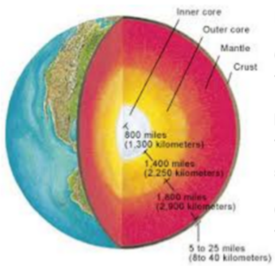
1. "The white-crowned sparrows look like they are plain gray from far away."
2. "Sometimes these birds will make short flights to catch an insect to eat."
3. "It is fun to watch for white-crowned sparrows."
4. "These birds are so common that they may live close by."

A Hole in the Earth

Back in March of 2007, a team of 12 British scientists set sail aboard the RRS James Cook to find out why a large chunk of Earth's crust, or outer layer, is missing three miles below the surface of the Atlantic Ocean. In its place is a large, exposed stretch of mantle—the deep inner layer of Earth.

The crew departed from the Canary Islands, which are located off the northwestern coast of Africa. The hole is situated about 2,300 miles southwest of the Canaries. Scientists suspect the hole is 30 miles long and 30 miles wide. Using a robotic device called Toby, the team will film the site and take samples to study. "It is like a window into the interior of Earth," says scientist Bramley Murton from aboard the research ship.

The Earth's Core



Earth is made up of four layers, which get hotter and hotter from the surface to the center.

Crust (5–25 miles thick)

The crust is the surface of Earth. The thin layer is made of solid rock.

Mantle (about 1,800 miles thick)

The mantle is divided into two parts: the upper mantle and the lower mantle. Most of the mantle is solid rock, but the lower mantle rock is softer.

Outer Core (about 1,400 miles thick)

The hot outer core is made of liquid iron and nickel.

Inner Core (about 750 miles thick)

The inner core is the center of Earth. It is made up of scorching-hot iron and nickel, which stay solid due to intense pressure.

↑ Hide Passage

Which statement supports the main idea of this passage?

- ○ The layers in Earth get hotter and hotter toward the center.
- ◉ Scientists are studying a mysterious hole in the surface of the earth. ✔
- ○ A robotic device is helping scientist learn about the hole.

Sample MAP® Test: MAP Reading

Read the passage.

The White-crowned Sparrow

1 Sparrows are small, common birds. They live in most parts of North America. There are many kinds of sparrows. These birds live in many different places, or habitats. Sparrows can live in the city or the country. The white-crowned sparrow is one kind of sparrow.

What They Look Like

2 The white-crowned sparrows look like they are plain gray from far away. However, these birds actually have black and white stripes on their heads. They also have small, pale pink or yellow bills. Their chests are pale gray, and they have white bars on their wings. Their backs are soft brown, and they have long tails.

Where They Live

3 White-crowned sparrows live in brushy areas. They prefer woodlands and thickets, which are areas with lots of trees and bushes. They use the nearby open areas to look for food.

What They Eat

4 White-crowned sparrows eat many kinds of seeds, including sunflower seeds. They like grasses and grains, too. They also like blackberries. Sometimes these birds will make short flights to catch an insect to eat.

How They Nest and Raise Their Young

5 These birds make nests in shrubs. They build them up to 10 feet high. The female makes the nest with twigs. Then, she lines the nest with soft grass and feathers. The female lays 3-7 light blue-green eggs. The eggs have brownish spots. It takes the eggs 11-14 days to hatch.

6 After the eggs hatch, the female bird stays on the nest for 7-12 days. Both the males and females feed the young birds. After 12 days, the male sparrow keeps feeding the baby birds. Then, the female starts to build another nest where she will lay more eggs.

What is the most likely reason the male sparrow stays with the young birds?

1. Female sparrows can fly farther to get more food.
2. Male sparrows are better at caring for the young birds.
3. Female sparrows are the only ones that can lay eggs in the nest.
4. Male sparrows are the only ones that can find seeds for the young birds.

ScootPad® unit 9

Passage (1)

Excerpt from "Anne Hutchinson"

Anne was a midwife, and very helpful to those needing her assistance, as well as forthcoming with her personal religious understandings. Soon she was hosting women at her house weekly, providing commentary on recent sermons. These meetings became so popular that she began offering meetings for men as well. Following complaints of many ministers about the opinions coming from Hutchinson and her allies, the situation erupted into what is commonly called the Antinomian Controversy, resulting in her 1637 trial, conviction, and banishment from the colony, followed by a March 1638 church trial in which she was excommunicated.

Hutchinson is a key figure in the study of the development of religious freedom in England's American colonies and the history of women in ministry. She challenged the authority of the ministers, exposing the subordination of women in the culture of colonial Massachusetts. She is honoured by Massachusetts with a State House monument calling her a "courageous exponent of civil liberty and religious toleration." Her well-publicised trials and the accusations against her make her the most famous, or infamous, English woman in colonial American history.

Passage (2)

Excerpt from History of the Colony and Province of Massachusetts by Thomas Hutchinson, 1776

Mrs. Hutchinson: I am called here to answer before you but I hear no things laid to my charge...

Governor Winthrop: Why do you keep such a meeting at your house as you do every week upon a set day?

Mrs. Hutchinson: It is lawful for me to do so, as it is all your practices, and can you find a warrant for yourself and condemn me for the same thing? The ground of my taking it up was, when I first came to the land because I did not go to such meetings as those were, it was presently reported that I did not allow of such meetings but held them unlawful and therefore in that regard they said I was proud and did despise all ordinances. Upon that a friend came unto me and told me of it and I to precent such aspersions took it up, but it was in practice before I came. Therefore I was not the first.

Hide Passage

Based on the text structure, which excerpt is more apt to be more opinionated?

- ○ "Anne Hutchinson"
- ● History of the Colony and Province of Massachusetts ✔

Scootpad Unit C

An excerpt from *Only Gold* by J. S. Adams

The chill air of autumn came, and no longer could the fruits and berries ripen for him. He saw some laborers one day in a field nearby, eating their meal which they had brought from their homes. Oh; what would he not now give for some of their meat and bread! "I will go to them," he said, "and offer some of my golden stores in exchange for just a few morsels."

He did so; and they only smiled at his offer, saying, "What would then refresh and fit us for the rest of our day's labor? Surely your gold would not."

"But it would help you to buy more," he replied.

"Yes, to-morrow: but we cannot spare a morsel to-day, for we need all our supply to strengthen us for our work."

He turned away in deep thought. Was he not losing all of life's joys and comforts in living thus alone only to amass such quantities of gold? But as he looked again on the shining treasures his ambition arose with increased power; and he forgot, for a time, his hunger in his toil. Then a new thought came to him. "Now that the fruits are gone I can go to the forest and gather nuts. They will be better food, too, for these chilly autumn days. Surely I am provided for, at least till winter," and he left his labor and repaired to the woods, where he feasted and gathered enough for many days.

The household mourned much for their absent brother. They missed him in their daily joys, and every hour they watched, waited, and hoped to see him return. They almost rejoiced when the bleak winds of autumn swept the foliage from the trees, because they could look farther down the road for their brother.

"I shall soon be able to travel and see the world," said the youth to himself every day as the pile of gold grew higher; but, alas for human calculation! he awoke one morning to find his huge mountain of gold one solid mass. The action of the light, heat, and atmosphere had fused them together, and no exertion of his could break off even the smallest atom.

Must he return with not even one golden pebble? for he had gathered them all--not one was in sight, no more were to be found.

His golden dream of travel was over, and, worse, the freshness and buoyancy of youth had departed. His limbs, alas! were stiff and sore. He had a mountain of gold, not one atom of which he could use for himself or others. And now he must return to his father's house empty-handed, and void of truths or incidents to relate to his brothers.

But some kind angel led him home, where his blessings were yet in store, awaiting his return. One evening when the shadows crept over the earth, he walked up the well-known path. The brothers had long before ceased to watch for his coming; and great was their surprise to see him again among them, although not the brother of that happy, sunny day of long ago. He told them sadly of the result of his long toil, while they related to him the good results of their few golden pebbles, which they brought home, and with which their father had purchased land, which was now yielding them rich returns, aside from the health and pleasure which they derived from its culture, the labor of which they performed with their own hands. "Health, wealth, and happiness combined," he murmured sadly, as he felt keenly that his youth and opportunities had departed.

Are there not too many who seek for gold alone, forgetting the joys which it purchases, and forgetting that its possession alone has no value? Rightly acquired and used it alleviates and mediates, but gathered and amassed for itself only it is but a mountain of shining ore, valueless and unsatisfying to its possessor.

"Fool that I have been thus to waste my time and strength!" said the long-absent son that night as his father bade him welcome.

"If wisdom is purchased by the experience, it matters not how great the price," answered his parent.

Hide Passage

APPENDIX C

CONSENT FORM FOR CLASSROOM TEACHER

I agree to participate in the research project titled *Computer Adaptive Homework and Computer Adaptive Assessment* by Darla Bennett-Smailis, a doctoral student at Northern Illinois University. I have been informed that the purpose of the study is to examine the use of computer-adaptive homework and its impact on computer-adaptive assessment at the fifth grade level with attention placed on the role of self-regulation.

I understand that if I agree to participate in this study, I will be asked to do the following: collect parent consent slips (approximately 10 minutes), inform my fifth grade students of the study (approximately 10 minutes) and have them sign an assent slip (approximately 10 minutes), administer the questionnaire (approximately 30 minutes), and collect pretest and posttest data from children participating in the study (approximately 20 minutes).

I am aware that my participation is voluntary and may be withdrawn at any time without penalty or prejudice, and that if I have any additional questions concerning this study, I may contact Darla Bennett-Smailis at [redacted] or Dr. Elizabeth Wilkins, Professor, Department of Leadership, Educational Psychology and Foundations, College of Education, Northern Illinois University, at ([redacted]. I understand that if I wish further information regarding my rights as a research subject, I may contact the Office of Research Compliance at Northern Illinois University at [redacted].

I understand that the intended benefits of this study include the potential for fifth-grade students at Wood View Elementary and R.C. Hill Elementary to develop self-regulation as they complete their homework assignments. Benefits for the field of education include gaining insights about the use of computer-adaptive homework and its relationship to computer-adaptive assessment, the extent to which the use of this format can be used to advance the development of self-regulation strategies in fifth grade students, and how the use of these strategies can bring about academic achievement.

I understand that all information gathered during this study will be kept confidential by securing test records, notes, recorded and transcribed data, and other paperwork in a locked cabinet. Information created and stored electronically will be password protected; however, I also understand that, when participating in group lessons and activities, confidentiality among the children in the group cannot be guaranteed.

I understand that my consent to participate in this project does not constitute a waiver of any legal rights or redress I might have as a result of my participation, and I acknowledge that I have received a copy of this consent form.

______________________________ ________________________

Signature Date

APPENDIX D

CONSENT FORM FOR PARENT

Your child/ward is invited to participate in a research study titled *Computer Adaptive Homework and Computer Adaptive Assessment* being conducted by Darla Bennett-Smailis, a doctoral student at Northern Illinois University.

The purpose of the study is to examine of the study is to examine the use computer-adaptive homework and its impact on computer-adaptive assessment at the fifth grade level with attention placed on the role of self-regulation.

Your child's/ward's participation in this study will last one semester. He or she will be asked to take a self-regulated learning questionnaire (approximately 40 minutes) before the activities of the study begin and again after the activities of the study have concluded (approximately 40 minutes). (The questionnaire will take 35-45 minutes). The tests will be administered to your child/ward by using a secure computer website child/ward by the classroom teacher.

Your child will be asked to take part in 45 computer-adaptive discussion lessons that will be presented over a nine-week period. Your child may be asked to participate in a discussion about the computer-adaptive homework format. The discussion will be approximately 40 minutes in length 4 times a week. The discussions will begin as a whole group discussion on the computer-adaptive homework and then your child may be asked to work in a small group to discuss a computer-adaptive homework issue that is relevant to his/her current homework concern. Your child may be asked to participate in the computer-adaptive homework learning strategy lessons. These lessons will last approximately 40 minutes four times a week. Your child will learn useful homework strategies that may help him/her to become more self-regulated in the context of completing his/her homework.

Your child's name will be changed to another name in typed records of the discussions and in any reports, notes, or publications that are made from those records. The data will be stored in a locked cabinet throughout the study. Computer files of the typed records will be password protected. At the conclusion of the study, data will be destroyed by an individual that specializes in the destruction of confidential recordings and documents.

A benefit your child/ward may personally receive from participating in this study will be the opportunity to improve computer-adaptive assessment strategies. Another benefit your child/ward will receive will be the opportunity to develop self-regulation learning strategies that can be applied to future learning.

Information obtained during this study may be published in scientific journals or presented at scientific meetings, but any information that could identify your child/ward will be kept strictly confidential. Your child's name will be changed to another name in any written reports, published writing, or presentations made about the study. All written reports, notes, and recordings will be kept in a locked file, and any information that is typed and stored on computers will be protected by passwords. At the conclusion of the study, all collected information will be destroyed. I understand that when participating in group lessons and activities, confidentiality among the children in the group cannot be guaranteed.

Participation in this study is voluntary. Your decision whether or not to allow your child/ward, as well as his or her assent to participate will not negatively affect you or your child/ward. Your child/ward will be asked to sign an assent to be involved in the study immediately prior to participation, and will be free to withdraw from participation at any time without penalty or prejudice.

Any questions about the study should be addressed to Darla Bennett-Smailis at [redacted] or Dr. Elizabeth Wilkins, Professor, Department of Leadership, Educational Psychology and Foundations, College of Education, Northern Illinois University, at [redacted]. If you wish further information regarding your rights or your child's/ward's rights as a research subject, you may contact the Office of Research Compliance at Northern Illinois University at (815) 753-8588.

I agree to allow my child/ward to participate in this research study and acknowledge that I have received a copy of this consent form.

____________________________________ ______________________________

Signature of Parent/Guardian Date

APPENDIX E

ASSENT FORM FOR PARTICIPANT

I agree to participate in the research project titled *Computer-Adaptive Homework and Computer-Adaptive Assessment* conducted by Mrs. Bennett-Smailis a doctoral student at Northern Illinois University. I have been informed that the purpose of the study is to examine the use of a computer-adaptive homework platform and computer-adaptive assessment.

I understand that if I agree to participate in this study, I will be asked to complete my homework using a computer-adaptive homework four days each week for the first semester. I may also be asked to participate in whole group discussion and small group discussions on topics that involve the computer-adaptive homework platform. Also if I participate in this study, I will be asked to complete a questionnaire that will be read to me by the teacher (ADD TIME ELEMENT HERE).

If you do not want to be a part of the lessons, it is okay to say “no.” You will not get in any trouble if you say “no” or if you say “yes” now and decide later that you do not want to be part of the lessons. You can stop being a part of the lessons at any time if you want to, and that will not be a problem.

Would you like to be a part of the lessons and the activities that I have planned? I hope that you do! If you would like to be a part of the lessons, then all you need to do place an X by the word Yes. If you would not like to be a part of the lessons, then all you need to do is place an X by the words, No, Thank you. Please sign your name on the line too.

______Yes, I would love to be a part of this study!

______ No, Thank-you

________________________________ ________________________________

Name of Participant Date

APPENDIX F

REQUEST FOR PERMISSION TO CONDUCT RESEARCH

Northern Illinois University
College of Education
Department of Leadership, Educational Psychology and Foundations
DeKalb, Illinois 60115-2896
815-753-4404
Fax 815-753-8750
lepf@niu.edu

October 1, 2015

Dear [redacted],

My name is Darla Bennett-Smailis and I am a doctoral candidate at Northern Illinois University working on my dissertation investigating the effects Scootpad®, a computer-adaptive homework platform, may have on fifth grade students' Measure at [redacted].,

I would like to request your permission to conduct research in your building, during the academic school year 2015-2016 at [redacted] in two of your fifth grade classrooms.

Please let me know if you need further explanation of the research. Thank you for your time and consideration.

Respectfully,

Darla Bennett-Smailis

[redacted]

MEMO

Date: August 17, 2015

To: Darla Bennett-Smailis

From: [redacted]

Re: Application to Research in Wood View Elementary School

This memo is to inform you that you have been approved to conduct research in [redacted].

It is the understanding that during the 2015-2016 school year an examination of the effects Scootpad®, a computer-adaptive homework platform, may have on fifth grade students' Measure of Academic Progress (MAP), a computer-adaptive assessment at [redacted]ol. While the fifth grade students MAP assessment scores at [redacted] will be used as the control group, because they will not use a digital platform to complete homework.

I look forward to the outcomes of your research.

Good Luck,

[redacted]