THE EFFECTS OF STUDENT SELF-ASSESSMENT WITH GOAL SETTING ON FOURTH GRADE MATHEMATICS STUDENTS:

CREATING SELF-REGULATING AGENTS OF LEARNING

by

Laura Dvornick Clift

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

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ABSTRACT

With the national trend toward student accountability as learners, few studies have identified effective instructional strategies that motivate elementary students in becoming agents of learning and the effect of these strategies on academic achievement. This quantitative study investigated the effect of student self-assessment with goal setting (SAGS), based on the work of Stiggins, Arter, Chappuis, and Chappuis (2006), on elementary school students' academic achievement and motivation in mathematics. This study employed a quasi-experimental, pretest-posttest, nonequivalent control-group design. Participants were 130 students drawn from six intact classes of fourth graders from five elementary schools located in a large Archdiocese in the Pacific Northwest. Participants completed a pretest consisting of the Motivated Strategies for Learning Questionnaire (modified) and the Fraction and Decimals Unit Assessment. During the unit of study, both the control and intervention groups received instruction through traditional strategies; however, the intervention group also received the intervention strategy of using the process of self-assessment with goal setting (SAGS). After completion of the unit of study, participants in both groups completed posttests. Data from both pretests and posttests were statistically analyzed using ANOVA and ANCOVA procedures. This study reported the results and interpretations, along with recommendations for future research.

Key words: academic achievement, goal setting, instructional strategy, motivation, self-assessment, self-regulation

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List of Abbreviations

Analysis of Variance (ANOVA)

Analysis of Covariance (ANCOVA)

Multivariate Analysis of Covariance (MANCOVA)

Modified Motivated Strategies for Learning Questionnaire (MSLQ(modified))

Student Self-assessment with Goal Setting (SAGS)

CHAPTER ONE: INTRODUCTION

One outgrowth of the standards-based reform movement is the migration to Common Core State Standards (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). These new standards include an underlying assumption that students are agents of learning – the student is the locus of control. Therefore, students are responsible for self-regulating their learning. Self-regulated learners rely on a variety of tools to motivate and guide their desire to learn (Zimmerman, 1990). Educators are constantly seeking instructional strategies that increase student motivation, lead to higher academic achievement, and foster self-regulated learning (Cheng, 2011). Identifying these strategies is paramount to ensuring that students develop the skills deemed necessary for the successful implementation of the new standards. Unfortunately, a significant gap in the literature exists regarding instructional strategies for the elementary level that foster self-regulation. These self-regulating strategies are actions and processes directed at acquisition of information or skills that involve agency, purpose, and perceptions of learners. According to van Lier (2008), agency revolves around the activity of the learners and their engagement with learning. Furthermore, self-regulated learners set their purpose as to proactively seek out information when needed and take necessary steps to master this learning (Zimmerman, 1990). Finally, self-regulated learners perceive themselves as thinking, feeling, and acting on their own learning initiatives (Cheng, 2011). One potential strategy to strengthen students' development of self-regulation practice is the use of student self-assessment with goal setting (SAGS). This study investigated whether student use of SAGS led to higher levels of academic achievement and increased students' motivation, thereby identifying the strategy as a valuable instructional strategy in developing students as self-regulating agents of learning.

Chapter One provides foundational information regarding the research study, including information on present reforms. This chapter begins with a brief description of the theoretical framework on which the study rested, followed by a synopsis of the problem the study sought to address, as well as the study's purpose and significance. Then, the chapter discusses the independent, dependent, and control variables and provides key terms and definitions. The chapter continues by presenting the research questions and hypotheses and concludes with discussion on the study's research design, including the statistical analyses procedures.

Background

Over the course of history, there have been many demands to improve education and educational reform remains a hotly debated topic today (Ball, 2013). Reform has taken many forms and directions, and the meaning and methods of education have changed as a result. Two strands of reform have emerged over time: the accountability standards and the curriculum standards movement (Carbonaro & Covay, 2010). The curriculum standards movement has led to recent reforms including the standards-based movement with its turn toward national standards, illustrated by the Common Core State Standards. Common Core State Standards remain important to educators today and will significantly change the face of education for the future. This initiative rests on an underlying assumption of students as agents of learning (Zemelman, Daniels, & Hyde, 2012). A critical dimension of curriculum leadership is the continuous reconsideration of forces and trends that impact curriculum (Parkay, Hass & Anctil, 2010). One such force affecting the future of education is the emerging role of students concerning their own learning. Developing student accountability is a key component in the art of teaching (Danielson, 2007) and current best practice (Zemelman et al., 2012). Of key interest is the identification of effective instructional strategies that aid educators in developing self-regulating agents of learning.

As agents of learning, students are responsible for self-regulating their own learning. An ongoing trend in education is to transfer control for the responsibility for learning from the teacher to the student (Cheng, 2011; Hannafin, 2001; McClelland & Cameron, 2011; Zimmerman, 1990). Teaching is not just providing students with knowledge, but also helping students develop their intrinsic motivation and self-efficacy to enhance their learning values (Cheng, 2011). However, few studies have identified effective instructional strategies that motivate students in becoming agents of learning or the effect of these strategies on academic achievement (Dignath & Buttner, 2008). Self-determination has been positively linked to student motivation and increased school engagement and learner empowerment (Brooks & Young, 2011; Ryan & Deci, 2009), while self-regulation has been shown to impact academic achievement (Zimmerman, 1990). Motivation affected upper elementary students' beliefs about the stability and controllability of intelligence, goals, and behaviors (Volger & Bakken, 2007). Additionally, goal setting theory (Locke & Latham, 1990) with its tie to motivation, has been used extensively in sports (Sullivan & Strode, 2010), but to also increase student participation in learning and increase students' attitudes about learning (Sivaraman, 2012). According to Smithson (2012), goal setting increased or maintained academic assessment scores in elementary reading, while the use of self-regulation practices had a positive impact on student achievement in eighth grade science (Peters, 2012). Day and Tosey (2011) asserted well-formed outcomes, entitled POWER goals, offered a more rigorous and holistic approaches to goal setting. Furthermore, Stiggins et al. (2006) have applied principles of self-regulation in the development of the Classroom Assessments *for* Student Learning program. Key elements of this program include student self-evaluation and the setting of learning goals. Unfortunately, limited research surrounding the achievement and motivational effect of goal setting tied to self-assessment as an instructional strategy has emerged and rarely have studies applied goal-setting theory to academic performance (Dishon-Berkovits, 2014).

Typically, studies focused on high school and college students and few studies exist at the elementary level. Perhaps researchers focused on the higher order thinking skills that students possessed at these higher educational levels. The cognitive development of elementary students, specifically at the fourth grade level, was significant to this study; therefore, understanding their cognitive demands was imperative. Within Piaget's four stages of cognitive development, students at the fourth grade level would be at the concrete operational stage (Miller, 2011). At this stage, abstract hypothetical thinking has not yet developed, and children can only solve problems that apply to concrete events or objects (Myers, 2014). An intervention attempting use of the abstract constructs of self-regulation must make these constructs concrete in fashion. McClelland and Cameron (2011) called for the designing of interventions that target key components of self-regulation at different developmental periods. Zimmerman (2011) identified the emergent issue of whether teachers can modify their classrooms to foster increases in self-regulated learning among their students. Since self-regulation ability is teachable (Pintrich, 2006), it was recommended that schools consider injecting self-regulated learning into the curriculum and teachers set it as one of their teaching objectives (Cheng, 2011). A gap in ascertaining effective instructional strategies at the elementary level existed. Therefore, it was important to identify instructional strategies that utilized constructs of self-regulated learning to develop students as agents of learning. As Stiggins (2009) stated, "nowhere are these kinds of strategies more important than in upper elementary grades, because this is when the foundations of one's sense of oneself as a learner become solidified" (p. 419). Educators must look for ways of promoting self-regulation, such as encouraging students to self-monitor their learning and reflect on reasons for this learning (Labuhn, Zimmerman, & Hasselhorn, 2010). It was hoped that research, with Institutional Review Board (IRB) approval (see Appendix A), on SAGS and its effect on students' academic achievement and motivation, would lead to better understanding on how to assist students in becoming self-regulating agents of learning at a younger age.

Several theories supported the use of student self-assessment with goal setting. First was the social cognitive theory of Bandura (1991), which provided a framework for looking at self-assessment with goal setting in the social context of elementary classrooms. According to Bandura (1991), behavior is motivated and regulated by self-influences. These influences are the self-monitoring of one's behavior, identifying what determined the behavior, and the effects of the behavior. Individuals self-judged their behavior in relationship to personal standards and environmental circumstances. Such self-regulation also includes self-efficacy that, with its impact on thought, affect, motivation and action, is central in exercising personal agency. Using self-assessment with goal setting allowed learners to realize self-influence as described by Bandura. As students employed self-monitoring techniques, their cognitive engagement increased leading to higher levels of personal learning. During the self-evaluation phase, students reflected on the learning demonstrated. Students judged their learning in relationship to personal standards and within the context of expected learning among peers. Students set appropriate learning goals and once set, behaviors to meet these goals were determined. Finally, when students achieved the goals, they realized the effect of learning behavior. As the students in this study recognized their role as a learning agent, their self-efficacy increased. The social circumstances of teacher and peer expectations and support bolstered this self-judgment.

Building on Bandura's work was self-regulated learning theory, popularized by Zimmerman and Schunk (1989) and used originally to study adult learners in educational psychology. Self-regulated learning emphasized the autonomy and responsibility of students to take charge of their own learning, with a focus on awareness of thinking, use of strategies, and sustained motivation (Paris & Winograd, 2001). Self-regulated learning differentiated between three phases of learning: the pre-action phase/forethought, the action phase/performance and volitional control, as well as the post-action phase/reflection (Perels, Dignath, & Schmitz, 2009). The process of self-assessment with goal setting fully embraced these three phases.

The theory of self-regulation grounded this study. This theory postulated that individuals have the ability to understand and control their learning environment. By becoming active participants in their own learning, students could self-regulate their learning metacognitively, motivationally, and behaviorally (Zimmerman, 1990). A second feature of self-regulated learning was the self-oriented feedback loop (Carver & Scheier, 1981; Zimmerman, 1989). As applied to this study, as self-regulating learners analyzed tasks, set productive goals, and selected strategies to achieve the goals, the theory held that the independent variable (student use of SAGS) had the potential to influence positively the dependent variables of academic achievement and student motivation in mathematics. Student use of SAGS provided an instructional strategy that optimized self-regulation processes in a concrete manner for students in the mid to late concrete operational cognitive stage. This study added to the literature on self-regulated learning by offering a potential instructional strategy that teachers could use to modify their classrooms and foster increases in self-regulated learning among their students. The aforementioned theories provided a theoretic basis justifying the inclusion of self-assessment with goal setting into current curricular practice. Each demonstrated a foundation in learning theory that supported the cognitive engagement and motivation entailed in such practice. This study added to the existing knowledge base of self-regulated learning and supported the findings of previous works (Joseph, 2006; Paris & Paris, 2001; Tok, 2013; Zulkiply, Kabit, & Ghani, 2008). Furthermore, this study built additional understandings of metacognition (Cubukcu, 2009; Joseph, 2006; Karably & Zabrucky, 2009) and enhanced awareness of the impact of self-assessment and goal setting on motivation and academic achievement (Akbari, Khayer, & Abedi, 2014; Kitsantas, Steen, & Huie, 2009).

Problem Statement

With the national trend moving toward student accountability as learners, Dignath and Buttner (2008) found few studies have identified effective instructional strategies that motivate elementary students in becoming agents of learning and the effect of these strategies on academic achievement and motivation. This study addressed the effect of the self-regulated learning strategy of self-assessment with goal setting on academic achievement and motivation of fourth grade mathematic students. It is important for educators to understand that self-assessment with goal setting prompts students to self-regulate their learning (McClelland & Cameron, 2011) and enhances students' academic achievement and motivation (Cheng, 2011). This intervention answered the call in the literature for teachers to modify their classrooms to foster self-regulated learning (Zimmerman, 2011) and design interventions that target key components of self-regulation (McClelland & Cameron, 2011), specifically at the elementary level. The problem this study addressed was the lack of previous research identifying effective instructional strategies that motivate elementary students in becoming agents of learning, or the effect of these strategies on academic achievement and motivation.

Purpose Statement

The purpose of this quasi-experimental, pretest-posttest nonequivalent control group study was to apply the theory of self-regulation (Zimmerman & Schunk, 1989) by measuring the effect of self-assessment with goal setting on academic achievement and student motivation, while controlling for the pretests, for fourth grade students at five Catholic elementary schools in an Archdiocese within the Pacific Northwest. Exploring this topic allowed teachers in this study to incorporate SAGS into instructional routines. Since the results of this study determined that SAGS led to higher levels of academic achievement, it becomes a valuable instructional strategy in developing students as self-regulated agents of learning. Additionally, it assists educators in meeting the mandates set forth by the Common Core State Standards. The presence of an intervention using self-assessment with goal setting was the independent variable in this study. Based on the work of Stiggins et al. (2006), student use of SAGS was an instructional strategy during which students went through a process of first self-assessing their responses to test questions and then setting learning goals. Students assessed their answers as correct or incorrect, and if incorrect, as a simple error or lack of understanding. In the next step, the student answered three open-ended short response questions about his learning and then set two personal learning goals to focus on during the unit of study.

Academic achievement and motivation defined the dependent variables. Academic achievement was defined as the accomplishment of anticipated instruction objectives against preset standards (Kellough & Jarolimek, 2008). As previously used by Clark et al. (2014) and Swanson, Orosco, and Lussier (2014), academic achievement was determined by the students' mean scores on a posttest administered at the conclusion of study. Motivation was defined as being moved to do something based on underlying attitudes and goals (Ryan & Deci, 2000).

Motivation was measured using the mean score on Motivated Strategies for Learning Questionnaire, modified (MSLQ - modified) subscales of Motivation and Learning strategies combined (Milner, Templin, & Czerniak, 2011). The pretests, which were used to ensure equivalence between the intervention and control groups (Warner, 2013), were covariates and they were statistically controlled for in this study. The confounding variables, teacher effectiveness and implementation of instruction, were also controlled for during the study through explicit teacher training.

Significance of the Study

This study was significant as it was important for educators to understand if self-assessment with goal setting moved students to self-regulate their learning. This topic may assist teachers in incorporating an instructional strategy that enhances academic achievement and motivation of students. This study added to the literature surrounding effective instructional strategies that foster self-regulated learning in classroom settings. SAGS was a valuable instructional strategy in developing students as self-regulated agents of learning.

This was important especially in the Archdiocese, and the larger Pacific Northwest, where many school districts have adopted instructional frameworks with assumptions of students as agents of learning (Center for Educational Leadership, 2012; Danielson, 2007, Marzano, 2007). This study had the potential to improve the teachers' repertoire of strategies. Since the study yielded positive results, self-assessment with goal setting as an instructional strategy would be shared with a larger portion of teachers.

Research Questions

This study examined self-assessment with goal setting as an instructional strategy. Furthermore, the study intended to investigate the impact of the strategy on academic achievement and motivation. Specifically, the research questions for this study were:

RQ1: Is there a statistically significant difference between the academic achievement and motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, while controlling for the pretests?

RQ2: Is there a statistically significant difference between the academic achievement posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the Fraction and Decimals Unit Assessment, while controlling for the pretest?

RQ3: Is there a statistically significant difference between the motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the MSLQ (modified), while controlling for the pretest?

Null Hypotheses

Alternatively, the following were the null hypotheses:

$H_0$1: There is no statistically significant difference between the academic achievement and motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, while controlling for the pretests.

$H_0$2: There is no statistically significant difference between the academic achievement posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the Fraction and Decimal Unit Assessment, while controlling for the pretest.

$H_0$3: There is no statistically significant difference between the motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the MSLQ (modified), while controlling for the pretest.

Identification of Variables

The independent variable was defined as an intervention using SAGS. The independent variable had two groups, control and intervention. The control group received traditional instruction during the mathematics fraction and decimal unit. The intervention group, in addition to receiving traditional instruction during the fraction and decimal unit, also received instruction on the SAGS process. SAGS was an instructional strategy during which students went through a process of first self-assessing their responses to test questions and then setting learning goals. Students assessed their answers as correct or incorrect, and if incorrect, as a simple error or lack of understanding. The student answered three open-ended short response questions about their learning and the setting two personal learning goals to focus on during the unit of study (Stiggins et al., 2006) followed.

The two dependent variables were defined as academic achievement and motivation. The students' mean scores on a posttest administered at the conclusion of study determined the first dependent variable, academic achievement (Clark et al., 2014; Swanson et al., 2014). The Fraction and Decimal Unit Assessment measured achievement. Both groups completed the assessment at the conclusion of the unit of study. The assessment consisted of 25 multiple choice and short response problems on content covered in the Fractions and Decimals component of the fourth grade mathematics curriculum. The scoring of the assessment used points ranging from 0 to 25. The items on the assessment were generated from a questions bank created from the accompanying Math Connects textbook's (Altieri et al., 2009) assessment resources, along with ReThink Mathematics! benchmark assessment tools. A panel of five experts validated the assessment, ensuring content and face validity. Additionally, to determine reliability, the researcher conducted Cronbach's alpha on the assessment.

Being moved to do something based on underlying attitudes and goals defined the second dependent variable, motivation (Ryan & Deci, 2000). The study used the mean score on the MSLQ(modified) to measure motivation (Milner et al., 2011). The researcher obtained scores at the conclusion of the unit of study to measure students' perceived motivation toward mathematics. The MSLQ (modified) consisted of 41 questions to that participants self-reported on using a 5-point Likert-type scale. The motivation score was a composite score computed by combining raw scores from the Motivation and Learning strategies subscales. The Motivation scale subscales included for this study were intrinsic goal orientation, task value, control of learning beliefs, and self-efficacy for learning and performance. The Learning strategies scale subscales included were elaboration, critical thinking, and metacognitive self-regulation. Previous research showed the modified MSLQs subscales as validated and reliable (Duncan & McKeachie, 2005; Metallidou & Vlachou, 2010; Milner et al., 2011; Pintrich, Smith, Garcia, & McKeachie, 1991). To determine reliability of the modified version of the MSLQ used in this study, the researcher conducted statistical analysis (Cronbach's α) on scores from each subscale obtained from the pretest.

As a pretest assesses both academic achievement and motivation, the pretest was a covariate and was statistically controlled for in this study. The academic achievement and motivation pretests consisted of the administration of the exact same assessments used for the posttest. Furthermore, the study controlled for teacher effectiveness and implementation of instruction as confounding variables through explicit teacher training. This training consisted of a review of the unit-pacing guide, instrumentation tools, and a question and answer session.

Definitions

Throughout, the study used several pertinent terms defined here.

1. *Academic achievement* is students' mean score on the Fraction and Decimal Unit Assessment - a test designed to measure accomplishment of anticipated instruction objectives against preset mathematical standards (Kellough & Jarolimek, 2008).
2. *Instructional strategy* is a strategy teachers use to guide classroom practice in ways to maximize student achievement (Marzano, 2001).
3. *Goal setting* is a process to guide students towards the next steps in learning within the framework of content standards (Stiggins et al., 2006).
4. *Motivation* is to be moved to do something based on underlying attitudes and goals (Ryan & Deci, 2000).
5. *MSLQ (modified)* is an acronym for the instrument Motivated Strategies for Learning Questionnaire (modified) (Milner et al., 2011; Pintrich et al., 1991).
6. *Self-Assessment* is the process during which students identifying their own strengths and areas for improvement (Stiggins et al., 2006).
7. *Self-regulation* is process whereby individuals have understanding and control of their learning environment (Zimmerman & Schunk, 1989) and in which students think, feel and act on their own initiative in order to achieve their learning goals (Cheng, 2011).

Chapter and Research Summary

As noted in this chapter, this study examined self-assessment with goal setting as an instructional strategy employing a quantitative method and followed a quasi-experimental, pretest-posttest, nonequivalent control group design (Campbell & Stanley, 1963). This was the most appropriate design since the researcher manipulated the independent variable and used a control group, along with the administration of a pretest and posttest to both groups (Gall, Gall, & Borg, 2007). Although developed as an experimental study, as it sought to find the difference between two groups by manipulating a variable, the study was without random sampling and assignment. Therefore, it was not of true experimental design but rather quasi-experimental (Campbell & Stanley, 1963). Random sampling and assignment were not possible due to the nature of the education setting; the classes were already intact at the introduction of the study.

During the study, the researcher assigned participating teachers and their students to either the control group or the intervention group. Each group received equivalent instruction on the mathematics fraction and decimal unit. Additionally, the intervention group received instruction on the process of using self-assessing with goal setting. Both groups had the MSLQ (modified) assessment and the Fraction and Decimal Unit Assessment administered prior to intervention, and again at the conclusion of the unit of study. Results were statistically analyzed and reported.

Although the researcher intended to use the multivariate analysis of covariance (MANCOVA) to compare the mean Fraction and Decimal Unit Assessment and MSLQ (modified) posttest scores to determine if a statistically significant difference existed among the participants in the control group and the intervention group, violations of the assumption of an association between the two dependent variables precluded this analysis. The conduction of two separate analyses of covariance (ANCOVAs) were deemed more appropriate. An ANCOVA was performed to compare the Fraction and Decimal Unit Assessment posttest scores for the two groups to determine if a difference between mean scores existed between groups, while controlling for the pretest. Pretest scores were used as a covariate to reduce initial group differences that existed as intact groups were used for the study. An ANCOVA was used to assess the significances of difference between the mean posttest MSLQ (modified) scores based on participation in the intervention. Pretest scores were used as a covariate to reduce initial group differences that existed as intact groups were used for the study.

While Chapter One provides an introduction and overview to the research study, the following chapters provide more extensive information concerning this study. Chapter Two provides the rational for the study in the form of a literature review. Chapter Three explains the study design in detail while Chapter Four shares the results. Finally, Chapter Five provides discussion and recommendations for future research.

CHAPTER TWO: REVIEW OF THE LITERATURE

Introduction

Throughout history, there have been many demands to improve education and educational reform remains a debated topic today (Ball, 2013). These movements have changed the directions and the meaning and methods of education. Two recent strands of reform have emerged, the accountability standards and the curriculum standards movement. Both remain important to educators and will change the face of education significantly. A critical dimension of curriculum leadership is the continuous reconsideration of forces and treads that impact curriculum (Parkay et al., 2010). Regardless of the trend, the ultimate goal of education remains to help student become self-sufficient learners (Karably & Zabrucky, 2009). One such force affecting the future is the emerging role of students regarding their own learning. Of key interest is the effect of student use of self-assessment with goal setting on motivation and academic achievement.

With the national trend moving toward student accountability as learners, the problem is few studies have identified effective instructional strategies that motivate elementary students in becoming agents of learning and the effect of these strategies on academic achievement and motivation. This study addressed the effect of the self-regulated learning strategy of self-assessment with goal setting (Stiggins et al., 2006) on the academic achievement and motivation of fourth grade mathematic students. It is important for educators to understand if self-assessment with goal setting prompted students to self-regulate their learning (McClelland & Cameron, 2011). Exploring this topic will assist teachers in incorporating SAGS into instructional routines as a way to enhance academic achievement and motivation of students (Cheng, 2011). Since self-assessment with goal setting leads to higher levels of academic achievement and motivation, it would be a valuable instructional strategy in developing students as self-regulating agents of learning. Additionally, it will assist educators in meeting the mandates set forth by the Common Core State Standards.

This study was noteworthy, as it is important for educators to understand if self-assessment with goal setting moved students toward self-regulating their learning. This topic may assist teachers in incorporating an instructional strategy that enhances the academic achievement and motivation of students. This study adds to the literature surrounding effective instructional strategies that foster self-regulated learning in classroom settings. Self-assessment with goal setting is a valuable instructional strategy in developing students as self-regulating agents of learning. This is important especially in the Pacific Northwest where many school districts have adopted instructional frameworks with embedded assumptions of students as agents of learning (Center for Educational Leadership, 2012; Danielson, 2007, Marzano, 2007). This study has the potential to improve the teachers' repertoire of strategies. Since the study yields positive results, SAGS as an instructional strategy can be shared with a larger portion of teachers. Several theories supported the use of student self-assessment with goal setting.

Theoretical Framework

Several key theories prevalent to today's educational climate were relevant to this study. These theories provided a foundation of learning theory and addressed the cognitive engagement and motivation necessary to engage in self-assessment with goal setting. First was cognitive development theory.

Cognitive Development Theory

Piaget's cognitive development theory, from the 1950s, provided a framework for looking at self-assessment with goal setting within the developmental stage of the participants.

According to Piaget's work, children had specific interactions with objects or people and these interactions led to general understandings. As the child grew and developed, these understandings changed and thinking progressed through stages. These stages consisted of the sensorimotor period (birth to 2 years); preoperational period (2 years to 7 years); concrete operational period (7 years to 11 years); and finally, formal operations period (11 years to 15 years). Given these roughly estimated age ranges, the participants of this proposed study found themselves at the end of the concrete operational period. Miller (2011) described this stage as when:

> Children move from understanding based on action schemes, to one based on representations, to one based on internalized, organized operations. Thought is now decentered rather than centered, dynamic rather than static, and reversible rather than irreversible. Nature is reflected in a logical system of thought. However, concrete operations are still concrete – they can only be applied to concrete objects, with what *is* rather than what *could be*. (p. 56)

At this stage, young children can construct coherent beliefs, although often implicit and imprecise, by which they mediate effects to self-regulate (Zimmerman, 1990). These beliefs are about themselves and their confidence, along with "the nature of tasks, the usefulness and availability of cognitive strategies, and the social dispositions of other people in the classroom" (p. 13). As they mature, children can reflect on these beliefs and articulate them more fully (McClelland & Cameron, 2011). When presented with the tools used in the process of self-assessment with goal setting, the study anticipated that students would be able to articulate their internal understandings and thinking with concrete processes. Therefore, self-assessment with goal setting as employed in this study was an appropriate process to employ with learners at

Piaget's concrete operational stage. In addition to the cognitive stage of the participants, the social context of the study's setting was also important, as students do not learn in isolation. Rather, the elementary classroom is a social and dynamic environment.

Social Cognitive Theory

Social cognitive theory (Bandura, 1991) provided a framework for looking at self-assessment with goal setting within the social context of elementary classrooms. According to Bandura (1991), behavior was motivated and regulated by self-influences. These influences are the self-monitoring of one's behavior, what determines the behavior, and the effects of the behavior. Individuals self-judge behavior in relationship to personal standards and environmental circumstances. This self-regulation also includes self-efficacy that, with its impact on thought, affect, motivation and action, is central in exercising personal agency. Bandura's self-influence is realized when students use self-assessment with goal setting as proposed in this study. Joseph (2006) found personal learning occurred when individuals actively engaged with cognitive self-monitoring. In keeping with Bandura's concept of self-influences, during the self-evaluation phase students reflect on their demonstrated learning and judge this learning in relationship to personal standards and within the social context of expected learning among peers. Then, as students set appropriate learning goals, they also determine learning behaviors to meet these goals. Finally, when students achieve the goals, the students are able to realize the effects of the learning behavior. The student recognizes his own role as a learning agent and self-efficacy increases. The social circumstances of teacher and peer expectations and support bolster this self-judgment. The social context of learning also reverberated within the self-determination theory.

Self-Determination Theory

Self-determination theory, identified by Deci and Ryan in 1985, also had important implications for this study. Self-determination theory focused on how social and cultural factors affect people's sense of volition, initiative, well-being, and the quality of their performance. Events that supported an individual's sense of autonomy, competence, and relatedness fostered cognitive engagement and increased motivation. Cognitive engagement drew on the idea of investment, or the thoughtfulness and willingness to exert the effort necessary to comprehend and master complex and difficult ideas and skills (Fredricks, Blumefeld, & Paris, 2004). Students who invested in their learning were more engaged cognitively and vice versa. Furthermore, events that foster cognitive engagement also foster motivation. Motivation leads to enhanced performance, persistence, and creativity. However, if the social context was unsupportive or thwarted the individual's needs, a detrimental impact on wellness resulted (Ryan & Deci, 2000). It is important to provide strategies within the social context that affect cognitive engagement and motivation. Within the context of this study, the use of self-assessment with goal setting supported the aforementioned psychological needs of self-determination.

Self-Regulated Learning Theory

Building on the above-mentioned theories, Zimmerman and Schunk's work in the late 1980s popularized the self-regulated learning theory. When external guidance was absent, a student had to regulate the learning process himself. He had to "set a learning goal, plan the steps to achieve the goal, choose adequate learning strategies, monitor the progress, and finally, check the learning outcomes" (Kistner et al., 2010, p. 158). The student had to self-regulate his learning. Paris and Newman (1990) described self-regulated learning as the following:

> When students construct implicit concepts and beliefs about their abilities, their expectations for future success, the nature of academic tasks, the usefulness and availability of cognitive strategies, and the social dispositions of other people in the classroom. (p. 88)

Self-regulation emphasized the autonomy and responsibility of students to take charge of their own learning, with a focus on awareness of thinking, use of strategies, and sustained motivation (Paris & Winograd, 2001). Wirth and Leutner (2008) defined self-regulated learning as the competence to autonomously plan, execute, and evaluate learning processes that involved continuous decision making on the cognitive, motivational, and behavioral aspects of learning.

A large body of research suggested that self-regulation predicted school success (Cheng, 2011; Labuhn et al., 2010; McClelland & Cameron, 2011; Pintrich, 2006; Zimmerman, 1990) and high-achieving students could be characterized as highly self-regulated learners (Nota, Soresi, & Zimmerman, 2004; Purdie & Hattie, 1996; Zimmerman & Martinez-Pons, 1988). Self-regulated learners were "distinguished by their systematic use of metacognitive, motivational, and behavioral strategies; by their responsiveness to feedback regarding the effectiveness of their learning; and by their self-perceptions of academic accomplishments" (Zimmerman, 1990, p. 14). In the school setting, self-regulated learners were able to control their actions, achieved to their best abilities, and developed positive relationships with others (McClelland & Cameron, 2011). The more academic and social success children had in their early school experiences, the more likely they were to show high engagement in subsequent school settings (Blair & Diamond, 2008). Self-regulated learning theories of academic achievement emphasized how other people could help children learn tactics to regulate their own behavior and learning (Paris & Paris, 2001). These had the most direct application to the classroom and were distinct in their focus on how students selected, organized, or created learning environments, as well as how they planned and controlled their own learning.

Models of self-regulated learning built on the motivational and cognitive research to reveal how students chose academic goals, selected problem-solving strategies, and adjusted their plans and efforts according to their success (Paris & Newman, 1990). Wirth and Leutner (2008) described two models of self-regulated learning that offer different perspectives: component and process. The component perspective, popularized by Boekaerts (1999), presented self-regulated learning as a layering of embedded components representing the cognitive, metacognitive, and motivational aspects of self-regulation. Drawn from three schools of thought, the components of self-regulated learning included constructs from research on learning styles, metacognition and regulation styles, and theories of the self, including goal-directed behavior. Self-regulation is "not an event but a series of reciprocally related cognitive and affective processes that operate together on different components of the information processing system" (Boekaerts, 1999, p. 447). The process perspective, on the other hand, focused more on "the phases of events that constitute the ideal process of self-regulated learning and their typical requirements on the learner" (Kistner et al., 2010, p. 158). Process models focus on the before, during, and after phases of learning. Zimmerman (2000) defined these phases as forethought, performance or volition control, and self-reflection, while Perels et al. (2009) differentiated between the pre-action phase, the action phase, and the post-action phase. Within each phase, learners focused their attention to specific tasks. Furthermore, Zimmerman, Bonner, and Kovach (1996) proposed a cyclical model of self-regulated learning that was comprised of four correlated processes: self-evaluation and monitoring, goal setting and strategic planning, strategy implementation and monitoring, and strategic-outcome monitoring. Self-evaluation and monitoring was the first phase, during which students evaluated their personal effectiveness in relation to a specific learning task. The second phase of goal setting and strategic planning involved the setting of specific goals, the creation of learning plans, and the identification of learning strategies. During the third phase, strategy implementation, students employed strategies from their learning plans and monitored the strategies' effectiveness. In the final phase of strategic-outcome monitoring, students evaluated their personal effectiveness. Regardless of the perspective selected, the process of self-assessment with goal setting within this study fully embraced the components of self-regulation

Each of the previously mentioned theories provided a theoretic basis justifying the inclusion of self-assessment with goal setting into current curricular practice. Each demonstrated a foundation in learning theory that supported the cognitive engagement and motivation entailed in such practice. To build the foundation further, this chapter presents a review of the literature. Within the review, time was devoted to developing an understanding of current educational trends, specifically the emerging trend of students as responsible agents of learning. Next, the review gives attention to developing an understanding of motivation and its role in education. Then, the chapter shares the role of metacognition and learning to learn, followed by a review of academic achievement within the context of mathematics instruction. Finally, the chapter ends with discussion on the learning strategies of student self-assessment and goal setting.

Review of the Literature

Recent reform movements began with the release of A Nation at Risk in 1983. This publication led many states to turn to Outcome-Based Education, the predecessor of today's accountability standards movement. Outcome-based education (OBE) maintained a clear focus and organization of all aspects of an education setting around essential learning performances all students would successfully present at the conclusion of the learning experiences (Spady, 1994). OBE specified educational outcomes clearly and unambiguously. OBE also determined the content and organization of the curriculum, the course offerings, the methods, strategies, assessment, and timetable of instructional processes, and the classroom, as well as a framework for curriculum evaluation (Harden, 1999). This was the beginning of movement towards widespread standards in education. This movement culminated in 2001's No Child Left Behind (NCLB) legislation. NCLB supported standards-based education reform based on the premise that setting high standards and establishing measurable goals would improve individual outcomes in education (Sonoma County, 2013). NCLB expanded the federal role in public education through annual testing, annual academic progress expectations, report cards, teacher qualifications, and funding changes. This approach believed accountability through tighter control, more regulation, and frequent high-stakes standardized testing with tough consequences would improve schools (Shelly, 2008).

Contrary to this approach was the curriculum standards movement. At the center of this movement was the belief that authentic teaching and revamped teaching methods were the keys to school improvement (Zemelman et al, 2012). A by-product of this movement was the adoption of statewide instructional frameworks. The curriculum standards movement was a generalized, progressive educational paradigm shift. One key principle of this shift was student-centered teaching and learning.

Student as Agents of Learning

As elementary educators seek to renovate curriculum and instruction, one key focus must take precedent - student accountability as learners. One issue having a profound impact on curriculum is the lack of purpose and meaning of many students (Parkay et al., 2010). To achieve true educational improvement, students must find purpose and meaning as learners. The focus turns from the teacher to the learner.

The attention shift from teaching to learning was prevalent in today's literature (Danielson, 2007; Marzano, 2007; Van de Walle & Lovin, 2006; Zemelman et al., 2012). The inclusion of student assumption of responsibility for learning in instructional frameworks and teacher evaluation tools used by many school districts solidified this notion. Holtrop's *responsibility teaching* held "not only are teachers and schools called to act responsibility, but also that students be responsible agents, called to the task of maximizing their learning" (as cited in Van Brummelen, 2002, p. 38). Additionally, the mission of many school districts is the ideal of creating life-long learners among students. Therefore, students need to acquire knowledge and skills that will help them become capable lifelong learners after they leave school (Cheng, 2011). To this end, the task for educators is to engage pupils in learning, motivating them in become active learners or agents of learning, and remain such throughout life.

Instructional Strategies

Agents of learning possess certain skills that reflect self-determination and regulation. Bong, Cho, Ahn, and Kim (2012) examined the qualities of self-concept, self-efficacy, and self-esteems as predictors of academic achievement. Kitsantas et al. (2009) found developing effective self-regulated strategies was important for students to be successful across all academic domains, while Cubukcu (2009) found that teachers played a role in ensuring students were cognizant of the benefits of self-regulated learning. Additionally, agents of learning are able to self-evaluate their own learning. Gabriele (2007) examined the influence of achievement goals and comprehension monitoring (self-evaluation) on students' learning activities. Participants received instruction in designing a learning or performance goal prior to commencement of the study and the result indicated a positive influence on learning. Giota (2006) also examined the relationship between self-evaluation, goal orientation and academic achievement. Students self-evaluated goals for motivational factors that enhanced self-perceived competencies and increased academic achievement. Miller and Lavin (2007) reported a positive impact on elementary students' self-esteem, beliefs about competence, and enhanced views of themselves as learners after self-evaluation. Severance (2011) also investigated the effects of self-assessment on student performance. Results indicated students were able to perceive and articulate their own learning and the study recommended the development of procedures for students to address learning needs, with goal setting being one such procedure. According to Paris and Newman (1990), the hallmark of academic expertise was self-regulated learning. The path to achieve this level includes a series of conceptual changes about critical dimensions of schooling – fostering self-regulated agents of learning is one such change.

Developing instructional strategies that foster agents of learning is paramount. There are many instructional expectations placed on teachers and the classrooms of today requiring teachers to cope with the task of fostering students' self-regulated learning behaviors (Waeytens, Lens, & Vandenberghe, 2002). Additionally, teachers must find ways to facilitate students' learning and enhance students' skills (Labuhn et al., 2010). Teachers are to model, explain, and foster learning strategies throughout the curriculum as important cognitive tools for their students (Paris & Paris, 2001). To foster these behaviors, teachers need to be able to identify self-regulated strategies and discuss how and when they are used. Teachers first must develop their own individual self-regulating skills before assisting students in developing these same skills as students explore how to learn how to learn (Cubukcu, 2009).

The development of student self-regulation skills is necessary to improve student academic success. Numerous intervention studies revealed that training on self-regulated learning enhanced students' academic performance (Dignath & Buttner, 2008; Fuchs et al., 2003; Masui & DeCorte, 2005). Paris and Newman (1990) found that academic interventions that enhanced students' self-perceptions of their own ability, agency, control or efficacy did enhance their use of effective self-regulated learning strategies and when instruction "prompts students to participate actively and make thinking public, it provokes abiding changes in students' personal theories of learning and schooling" (p. 99). As students used these strategies in the right place and time, the strategies were effective for increasing academic achievement (Eker, 2014). One strategy teachers could employ to achieve these expectations is the explicit instruction of self-regulating behaviors.

Explicit Teaching

Teachers can promote self-regulated learning directly by explicitly teaching learning strategies. One such way is for teachers to tell students explicitly the benefits of a particular activity. For example, the teacher could clearly identify an activity as a learning strategy and that students could improve their performance by applying the strategy themselves (Kistner et al., 2010). Cubukcu (2009) found that students benefited from analyses and discussion of strategies for learning and Luttenegger (2012) showed that teachers' explicit strategy instruction related positively to students' use of strategies. Paris and Newman (1990) asserted that teachers could guide students in discovering and controlling effective learning tactics. Finally, Kitsantas et al. (2009) asserted students who truly wanted to learn were more likely to use self-regulated learning strategies to help them actually master material. As Pintrich (2002) postulated, the need to teach metacognitive knowledge explicitly is clear.

Brown, Campione, and Day (1981) called this explicit strategy *informed training*. Informed training included the teacher's role modeling during the application of a strategy, the verbalization of the teacher's thought processes, and the asking of questions to engage students in strategic behaviors (Collins, Brown, & Holum, 1991). Furthermore, teachers should inform students about the significance of a strategy and about how to employ, monitor, and evaluate the strategy (Kistner et al., 2010). Paris and Newman (1990) found students were motivated to use learning strategies independently when they understood what strategies were available, how they were applied, and when and why they were effective. Since the use of self-regulated instruction resulted in improved student attitudes (Hannafin, 2001), teachers should continue to demonstrate how to conduct self-regulation and choose strategies for learning by thinking aloud and teaching students the skills of self-monitoring through directed instruction (Zimmerman et al., 1996). This action control made the most significant contribution to students' learning performances (Cheng, 2011). These findings send an unmistakable message to educators that self-regulated learning can and should be taught. As agents of learning, students are engaged in learning and should perceive themselves as learners. One strategy to generate life-long learners is to increase student engagement and one key component to student engagement is motivation.

Motivation

As self-determined agents of learning, students strive for the inherent satisfaction of, or intrinsic motivation, to learn. Students need to be motivated to exert effort, to persist in the face of difficulty, to set challenging yet attainable goals, and to feel self-efficacy with their own accomplishments (Paris & Paris, 2001). Motivation is the process that initiates, guides, and maintains goal-oriented behaviors. In other words, motivation is what causes an action or the psychological force that drives an action (Ryan & Deci, 2000). Typically, two types of motivation present, either extrinsic or intrinsic. Although previously viewed as dichotomous, beginning in the 1990s these two forms were viewed more on a continuum than as direct opposites (Vallerand, 1993). Extrinsic motivation is an external force, often a reward or punishment, used to obtain an outcome. Conversely, an interest or enjoyment in the task itself drives intrinsic motivation. Intrinsic motivation exists within the individual rather than relying on external pressures or desires. Intrinsically motivated students, as described by Wigfield, Guthrie, Tonks, and Perencevich (2004), were more likely to engage in a task willingly, were more willing to work to improve their skills, and desired to see an increase their capabilities. They also preferred challenges and were persistent when faced with difficulty (Fredricks et al., 2004). Teaching is about helping students develop their intrinsic motivation and self-efficacy while enhancing their learning values, not just about providing students with knowledge (Cheng, 2011). Therefore, teachers should employ instructional strategies that are motivating.

Several studies have reviewed motivation and its impact on self-determination and learner empowerment. According to Brophy (2010), motivation to learn is “a student tendency to find academic activities meaningful and worthwhile and to try to derive the intended academic benefits from them” (p. 205-206). Palmer (2005) stated that motivation could apply to any process that activated and maintained learning behaviors. Motivation is crucial in education, as research showed it to influence interest, excitement, and confidence that in turn enhanced performance, persistence, creativity, and general well-being (Ryan & Deci, 2000).

Learning environments. An important prerequisite for increasing motivation through self-regulation in classrooms is a learning environment that enables and encourages students to learn in a self-determined way. These learning environments stress the importance of social interaction among students, active construction of knowledge, learning embedded in authentic situations, and the development of self-regulatory skills and result in better academic performance (Kistner et al., 2010). One educational setting to embrace fully the role of motivation was that of Montessori schools. Murray (2011) described Montessori schools as integrating the motivational principles of autonomy, competence, and relatedness into the key principles of education. Opportunities to cultivate self-regulation skills filled the Montessori environment (Boulmier, 2014). This educational practice promoted students who were engaged learning agents and actively motivated. Additionally, Rukavina, Zuvic-Butorac, Ledic, Milotic, and Jurdana-Sepic (2012) studied the impact of motivational environments on student attitudes. Their work described positive student engagement toward science and math instruction after individuals participated in learning within a motivational workshop environment. When students were actively engaged in their lessons, they eagerly participated and this type of learning developed positive attitudes toward the academic subject matter. Results indicated that teaching math and science through a motivational workshop model was more acceptable to students than traditional educational settings. These studies illustrate motivated students use effortful cognitive strategies based on personal beliefs and attitudes, as predicted by Paris and Newman (1990). Additionally, these results added to the knowledge base underscoring the positive impact of motivation on student engagement and self-regulation.

Self-talk. Furthermore, motivation in sports has been a focus of study. Tod, Hardy, and Oliver (2011) reviewed previous research on motivational affects in sports, specifically self-talk. Self-talk, or what Vygotsky (1978) referred to as private speech, is the internal communication a person holds with himself. Sports psychologists have long studied the impact of self-talk on athletes. Self-talk can be conceptualized as positive or negative, instructional or motivational. Tod et al. (2011) explained that positive self-talk aided performance while motivational self-talk focuses on self-efficacy and persistence toward long-term goal commitment. Motivational self-talk use has also been associated with persistence and subsequent performance on challenging tasks (Chiu & Alexander, 2000). Kuhl (1984) found that students benefited from using self-speech to limit anxiety about difficult tasks. Educators can gain much insight on the use of self-talk as a primary function during self-regulation and during the development of metacognitive skills.

Self-report measures. One way to measure self-regulated behaviors is by asking students about their self-regulating learning activities by means of questionnaires. These measures are usually self-reports that are collected before or after a specific learning task (Kistner et al., 2010). Pintrich and DeGroot (1990) researched motivation and self-regulation as integral components to learning and developed the Motivational Strategies for Learning Questionnaire (MSQL) as a tool to measure several aspects of motivation related to learning, including goal orientation and self-efficacy. Based on a cognitive view of motivation and learning, the authors designed this self-report measure to assess college students' motivational orientation and use of different learning strategies within a college course (Pintrich et al., 1991).

Student choice. Research has also indicated a positive connection between increased motivation and offering students choices in the classroom. Brooks and Young (2011) found offering students' choices in a classroom enhanced feelings of self-determination and intrinsic motivation. Providing students' opportunities for choice may yield higher perceptions as agents of learning. Patall, Cooper, and Wynn (2010) indicated choice facilitated positive learning outcomes, including increased motivation and perceived competence, as well as enhanced performance and academic achievement. Katz and Assor (2007) conducted a meta-analysis and found that "merely offering choice is not in itself motivating," (p. 439) rather choice carefully matched to students' needs offers autonomy, competence, and relatedness support. Goals should be relevant to students' interests (autonomy), not too easy or hard (competence) and congruent to students' values (relatedness). Indications from these studies support the use of choice as a tool to enhance motivation. Therefore, in addition to self-assessment with goal setting as an instructional practice, teachers should afford students the opportunity to choose their own goals with direct guidance. This action should affect students' perceptions as learners and agents of learning.

Recently, there has been a shift from a behaviorist perspective of motivation toward a social cognitive focus. This shift moves away from factors like rewards and punishment towards the importance of students' beliefs about themselves and their learning environment (Palmer, 2005). To self-regulate learning, students need both self-learning ability and motivation (Cheng, 2011). Additionally, an important aspect in learning complementing other motivational or strategic components of self-regulation is student effort investment (Magi, Lerkkanen, Poikkeus, Rasku-Puttonen, & Kikas, 2010).

Motivation's impact on education is clear. To create the life-long learners that many schools desire, schools must harness the motivation to learn. Several strategies to aid this endeavor exist, including metacognition and learning to learn.

Metacognition and Learning to Learn

Metacognition, or thinking about thinking, refers to a student's ability to monitor, control, and assess his or her own thinking (Flavell, 1979). Metacognition and learning to learn are the abilities to pursue and persist in learning or to organize one's own learning, including effective management of time and information (Cheng, 2011). That is, for students to become more responsible for their own learning metacognitively, motivationally, and behaviorally (Labuhn et al., 2010). Brown (1987) identified two primary principles of metacognition that are significant for learning, knowledge of cognition and regulation of cognition. Metacognitive knowledge referred to students' knowledge and beliefs about their mental resources, their awareness about what to do, and required them to define accurately and exactly their thoughts or knowledge (Özsoy & Ataman, 2009). Metacognitive regulation referred to students monitoring their own learning and determining whether they understood the subject or not, as well as selecting and applying learning strategies that were right for the time and place (Eker, 2014). Metacognition regulation consisted of *metacognitive experiences* that included students' ability to assess or evaluate their progress on cognitive tasks, as well as their ability to use strategies to regulate processes in a systematic manner (Karably & Zabrucky, 2009). Metacognitive experiences played an important role in the development, differentiation, and efficiency of metacognitive skill affecting subsequent learning behaviors (Roebers, Cimeli, Röthlisberger, & Neuenschwander, 2012). Metacognitive regulation, rather than metacognitive knowledge, was highly related to students' academic performance (Zulkiply et al., 2008).

Developmental aspects. Metacognition is a developmental and long-lasting process (Eker, 2014). Metacognition is shaped and elaborated upon through participation in *zones of proximal development* (Vygotsky, 1978). This construct described how a more skilled person "collaborates with a student using prompts, clues, modeling, explanation, leading questions, discussion, joint participation, encouragement, and control of attention" (Miller, 2011, p. 175). These interactions build on competences the student already possesses to move to a competency level slightly beyond, expanding metacognition. As students progress in age, they also develop improved identification and application of strategies (Bjorklund & Zeman, 1982; Moynahan, 1978; Yussen & Bird, 1979). These changes affect elementary-aged students. Roebers et al.

(2012) found metacognition directly and substantially influenced academic outcomes beginning in the third grade. Furthermore, Lovett and Ravelljhh (1990) found that at the third-grade level, students were beginning to distinguish between comprehension and memory processes. The students could also identify what strategies would improve each and how to focus specific strategies on each process exclusively. Schneider (1986) found fourth graders seemed to be more adept at choosing an appropriate and helpful strategy than younger students. By fifth grade, students were able to apply useful learning strategies in appropriate situations (Bjorklund & Zeman, 1982). Students in the concrete operational development stage are beginning to self-regulate their learning. Regardless of age however, individuals differ strongly in their ability to regulate their thoughts, and monitor and control cognitive and motivation processes in learning (Roebers et al., 2012). Although students can develop metacognitive strategies (Zulkiply et al., 2008), teachers play a pivotal role in developing agents of learning.

Self-regulated learning. One way to promote students' acquisition of metacognitive skills is to foster self-regulated learning. Guthrie (1983) found that when students became aware of their own learning processes, they were able to diagnose their needs and apply metacognitive strategies to eliminate their shortcomings. Joseph (2006) noted that instruction in metacognitive awareness helped students understand their role as learners, thus making them aware of critical strategies for improving classroom performance. When students made conscious decisions about their role as a learner for the purpose of a specific topic or about their existing knowledge, they employed metacognitive strategies (Zulkiply et al., 2008). As students engaged in these metacognitive strategies, they were both self-directed and overtly reflective about their learning experiences (O'Brian, Nocon, & Sands, 2010). Just as teachers can enhance student self-regulation through explicit teaching, so too can they foster students' application of metacognitive strategies through structured instruction.

Structured instruction. Özsoy and Ataman (2009) found the most significant advantage of structured instruction in metacognition was that it not only taught the skills, but also provided opportunities for teaching the where, when, and how to apply the skills. With structured instruction, teachers were able to point out potential times when strategy use would benefit their students (Karably & Zabrucky, 2009). One form of structured metacognitive strategy instruction is teacher modeling. Teacher modeling was most effective when it was explicit, leaving little for the students to infer, about either the strategy or its application (Luttenegger, 2012). Borkowski and Muthukrishna (1992) advised teachers to use explicit instruction of metacognitive strategies to ensure the strategies were clear and apparent. According to Karably and Zabrucky (2009), during the elementary years, children became aware of organizational strategies, learned to apply them and eventually used them spontaneously; therefore, it was helpful for teachers to point out situations where organization was helpful and encourage students to use it. Simply stated, structured and explicit instruction could increase metacognitive skills that then lead to higher academic performance.

Higher performance levels link to metacognitive monitoring. This monitoring, or the ability to reflect and evaluate one's performance and an individual's ability to differentiate metacognitively between correct and incorrect responses, related significantly to academic outcomes (Roebers et al., 2012). When involved in assessing their own academic growth, students become more aware of their learning goals and the results of their efforts (Joseph, 2006), thus developing their skills as agents of learning. Furthermore, Block (2004) found very young students could be taught to monitor and asses their own comprehension. However, students do not develop self-reflective abilities on their own. Joseph (2006) stated students need direct instruction with plenty of coaching and frequent reminders. Teachers, acting as competent support, can shape and elaborate the metacognitive skills of students. Students need to understand that self-reflective thinking is a vital life skill, and as Roebers et al. (2012) asserted, a strategic ability that extends beyond the classroom and into every day live.

Academic Achievement

Academic achievement is one way to assess a student's learning. According to Zulkiply et al. (2008), there was a direct connection and positive relationship between students' performance and their use of metacognitive strategies. Therefore, students who used available metacognitive strategies also achieved academically. This is due in part to the idea that while engaged in learning, students monitored their metacognition and determined whether they understood the subjects or not (Eker, 2014). Two strategies effective within academic contexts to link performance and metacognition are self-assessment and goal setting.

As students employ self-assessment and goal setting in academic contexts, achievement is affected. Within this proposed study, academic achievement is defined as students' mean score on a test designed to measure accomplishment of anticipated instruction objectives against preset standards (Kellough & Jarolimek, 2008) in the domain of mathematics. According to Tok (2013), specifically in the area of mathematics, metacognition was important for learning. In mathematics, metacognition affected how children learned or performed as they monitored and regulated the steps and procedures used to meet the goal of solving problems (Özsoy & Ataman, 2009). These studies highlight the need to teach metacognitive and self-regulated learning strategies explicitly as students face the increased cognitive demands of mathematics instruction today.

Mathematics of today. During the last two decades, important changes have emerged in mathematics education (Ocak & Yamac, 2013). The age-old mathematics curriculum no longer served the needs of students, schools or society as a whole (Mokros, Russell, & Economopoulos, 1995). One major shift was that mathematics was no longer conceived as solely a collection of mastered abstract concepts and procedural skills, but more of sense making and problem solving (DeCorte, Vershaffel, & Op'teynde, 2000). The two skills of sense making and problem solving involve critical thinking. The National Council for Excellence in Critical Thinking (n.d.) defined critical thinking as applying, analyzing, evaluating, and synthesizing information. These skills are at the pinnacle of Bloom's Taxonomy (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956), a system employed by educators to classify the complexity of different learning objectives. The more teachers stimulate students to be aware of their own thinking the better mathematic problem solvers students will become (Hyde, 2006). Additionally, problem solving aided students' beliefs that they are capable of doing mathematics (Van de Walle & Lovin, 2006). Akbari et al. (2014) found learning mathematics notions required students to manage and check learning processes. When students had metacognitive skills, they were more capable in solving problems that are more complicated and solving them quicker. The development of students' high level thinking capacity requires students to develop self-regulation strategies. To achieve this level of cognitive engagement, teachers should employ direct and explicit teaching of metacognitive strategies.

Metacognitive strategy instruction had a distinctive impact on increasing achievement (Akbari et al., 2014; Fredricks et al., 2004; Ozcan, 2014; Zulkiply et al., 2008), specifically in problem solving (Özsoy & Ataman, 2009). Within the mathematics domain, instruction in metacognitive strategies enabled learners to reach high-levels of cognitive engagement, allowed them to discover appropriate problem solving processes, and then use these processes under different conditions (Joseph, 2006). Students who had high metacognitive skills performed better in mathematics lessons than students who had lower metacognitive skills (Ozcan, 2014). As students used various cognitive and metacognitive strategies to regulate their own cognition, they became self-regulated learners. This transformation was appropriate within the nature of mathematical insight and sense making (Ocak & Yamac, 2013). Teachers should focus their attention on instructional strategies strengthen cognitive engagement and metacognitive skills. At the same time, it is equally important they do not neglect the learning environment, as it too is crucial.

Classroom environment. An important prerequisite for practicing self-regulation in classrooms is a learning environment that enables and encourages students to learn in a self-determined way. These learning environments stress the importance of social interaction among students, active construction of knowledge, and learning embedded in authentic situations. These environments develop self-regulatory skills and result in better academic performance (Kistner et al., 2010) and are student-centered. Polly et al. (2013) determined student-centered practices led to statistically significant gains on student learning outcomes, which further supported previous links between instructional practices in mathematics that reflected a student-centered view and positive student achievement. Furthermore, Paris and Newman (1990) determined classroom climate and structure also influenced student learning. Classrooms that fostered learning intentionally reinforced the expectation of small-group activity, collaboration, and help giving and seeking that were important for learning. Thus, the structure of classroom activities was an important feature around which teachers organized for learning.

Teachers can organize the environment and teach instructional skills explicitly to develop and foster metacognition in students, thus creating agents of learning. These metacognitive strategies include self-assessment, self-reflection, and goal setting (O'Brian et al., 2010). All three of these strategies are important in learning and affect student performance and academic achievement.

Strategies for Learning

To assist in the task of developing self-regulated learners, educators employ several strategies for learning. Two of these strategies are self-assessment and goal setting.

Self-Assessment

Assessment is the process of defining knowledge, skills, attitudes and beliefs (Chappuis & Stiggins, 2002). Many forms of assessment exist, yet most are divided between two categories, summative and formative. Much of educational history is rooted in summative assessments. These assessments were given at the conclusion of learning. Zemelman, Daniels, and Hyde (2005) asserted summative assessments are not even educational, rather a way of reporting periodically to outsiders what has been studied or learned. Many educational arenas use summative assessments predominately to determine student, teacher, and school success. Even more disturbing is the assertion that "most teachers are still wedded to [summative] evaluation procedures that are ineffective, time-consuming, and hurtful to students" (Zemelman et al., 2005, p. 314). Summative assessment continues to dominate education.

Formative assessment. Recently, there has been a push for increased inclusion of formative assessments. Formative assessment can be defined as an ongoing instructional process that systematically incorporates assessment into instruction (Hudesman et al., 2013). Black and Wiliam (1998) defined formative assessment as a process that involved teachers making adjustments to teaching in response to assessment evidence, students receiving feedback on what they can do to improve, and students participating in self-assessment. Formative assessment occurs while learning is still in process. These assessments help teachers and students gather information on current learning while there is still time to influence future learning. Assessment is formative when information gleaned is used to adjust instruction to better meet the needs of the students, as well as to provide feedback so students can shape their actions (O'Brian et al., 2010). In their 1998 meta-analysis of formative assessment, Black and Wiliam identified five practices that support formative assessment, for which they found substantial evidence of improvements in student learning outcomes. These included (a) teachers sharing evaluation criteria with students, (b) teachers provided descriptive feedback, (c) student self-assessment, (d) student-to-student peer assessment, and (e) using questioning in classrooms to learn about learning. Furthermore, they concluded that achievement gains generated by using formative assessment across a range of content domains were among the largest ever reported for education interventions.

Assessments *for* Learning. One forerunner in the realm of formative assessments is Richard Stiggins and his work with Assessments *for* Learning. According to Stiggins (1999, 2001), classroom teachers who directly involved students with assessment increased student confidence and motivation to learn. Students should be engaged users of assessment information and when engaged, use assessment information to set goals, make learning improvement decisions, develop an understanding of quality work, self- assess, and communicate progress toward learning goals (Chappuis & Stiggins, 2002). Students are only able to self-regulate their learning effectively if they monitor and evaluate their progress accurately and thus make adaptations based on a correct analysis of their performance (Labuhn et al., 2010).

A significant amount of literature is available concerning Assessment *for* Learning, and through the work of Assessment Training Institute (ATI, 2013); many teachers have developed the skills needed to gather formative information about student achievement, as well as to use the assessment process and results effectively to improve instruction. The concept of student-involved classroom assessment grounds the work of ATI. ATI, guided by the belief that helping students see themselves as learners - which is central to academic success - and that assessment practices are key to developing student competence and confidence, continues to promote formative assessment as a valuable instructional strategy (ATI, 2013).

Formative assessment practices are not without concern, however. Volante and Beckett (2011) suggested an imbalance in the use of formative assessment methods and teachers' tension in using particular strategies, specifically self-assessment. Although the consensus among the participants, that involving students in the assessment process was vital to student learning, they also acknowledged that such assessment must be carefully implemented in order to be effective. One key finding was the reassertion of assessment as a collaborative practice between teacher and student, with an emphasis placed on student self-judgment.

Self-judgment. A key type of student self-judgment is self-assessment, which refers to students comparing their learning outcomes with a goal or standard (Labuhn et al., 2010). Self-assessment involves the internalization of standards so students can regulate their own learning more effectively (Paris & Paris, 2001). According to Stiggins (2009), students draw inferences about themselves as learners from the time they enter school. Students base these inferences on intuitive self-judgements and self-assessments. Teachers can build on these intuitive skills by incorporating student directed self-assessment activities into instruction. During self-assessment, students are responsible for interpreting their own results, explaining what the results mean, and determining what actions to take to improve their learning (O'Brian et al., 2010). Self-assessment includes both reflections on and evaluation of one's work, it helps to develop feelings of ownership, and build responsibility for learning (Paris & Paris, 2001). Since students can more accurately predict what information they will attain on a short-term basis, Hannafin (2001) proposed an increase in students' regulation of instructional tasks within the classroom setting. Once students have finished a task, they have a more complete knowledge of the accuracy of their judgments; therefore, student self-assessment allows students to refer back to their experience with the task to determine their competence (Labuhn et al., 2010). This backward look requires student to calibrate their learning. Calibration is the degree to which a learner's subjective judgments about learning, such as claiming to know a fact, match the objective properties of that learning (Winne & Muis, 2011). In other words, can students accurately identify what they do and do not know? They can, and can at a relatively young age. According to Magi et al. (2010), a reciprocal relationship between achievement outcome and academic self-perception appeared in students at the second grade level, while students as young as in the first grade were able to differentiate between effort and ability. Paris and Newman (1990) found even young children could reflect upon their abilities and articulate them accurately; even if this reflection was implicit and imprecise, it could still mediate children's self-regulated learning. Therefore, fourth grade students should be able to self-assess their learning with competence. Self-assessment is important as it complements learning goals and helps students maintain high levels of self-efficacy (Paris & Paris, 2001).

Instrumentation. To aid students in self-assessment, teachers can utilize several instruments. One tool found to be effective was knowledge surveys. Clauss and Geedey (2010) found knowledge surveys were effective and useful in that the simple act of asking students to assess their abilities encouraged metacognition. Another common way to measure self-regulated behaviors is by asking students by means of questionnaires about their self-regulating learning activities (Fredricks et al., 2004). These measures are usually self-reports that are collected before or after a specific learning task (Kistner et al., 2010). Although self-report tools are least reliable form of measurement (Rovai et al., 2014), they remain one key instrument to assess students metacognition and self-regulation as agents of learning.

Much of the reviewed literature focused on teacher assessment of student learning; however, the aforementioned studies did place the locus of control for learning on the students. Student self-assessment within academia is happening. Unfortunately, the literature concerning the impact of student self-assessment on academic achievement, specifically for elementary students, was sparse. In its place, much of the literature at the elementary level focused on goal setting.

Goal Setting

Goal setting is a process to guide students towards the next steps in learning within the framework of content standards (Stiggins et al., 2006) and metacognitive strategies help students achieve goals (Eker, 2014). Locke and Latham (1990) are recognized as leaders in the field of goal setting theory. Their work applies primarily to business settings, but recent modifications opened this theory for use in academic arenas. The five principles in the goal setting theory are clarity, challenge, commitment, feedback, and task complexity. The theory postulates that goal setting can foster autonomy and competence, thereby affecting intrinsic motivation and students' perceptions as agents of learning. Patel and Laud (2009) conducted a study on the application of goal setting within academia and the results indicated that the use of goals enabled students to be more confident and comfortable in learning, and increased their enjoyment in the act of learning. This suggests that goal setting may drive a students' motivation for learning.

Mastery vs. Performance. Two orientations of goals have emerged, performance and mastery. Performance orientation refers to setting goals focused on competence or ability, how this compares to others, or goals that focus on surpassing others; while mastery orientation relates to setting goals that focus on learning a task, personal improvement, and increased understanding (Cheng, 2011; Middleton & Midgley, 1997). Performance goals are competition based, while mastery goals are learning based. Meece (1994) identified mastery goal orientation in academia as learning or task orientation. Goal orientation is a developmental perspective that should examine students' understanding of ability, the academic tasks, and motivation (Paris & Newman, 1990). Goal orientation, whether performance or mastery/learning, plays a role in self-regulation and student achievement.

Self-regulated learners are often distinguished from non-self-regulated learners by the types of goals they set - self-regulated learners set mastery/learning oriented goals, as opposed to performance goals. Additionally, they selected and used different learning strategies effective for achieving these goals (Kitsantas et al., 2009). Students who adopted learning goals focused on mastering the task, understanding the learning, and trying to accomplish something that was challenging (Fredricks et al., 2004). These mastery/learning goal orientated students strove to gain understanding of a concept, as opposed to performance-oriented students who aimed to outperform peers (Ames, 1992). Mastery/learning oriented students displayed higher levels of effort and persistence, they engaged in challenging tasks, and employed effective cognitive and self-regulated learning strategies. On the other hand, performance oriented students engaged in behaviors and strategies that supported their achievement less (Middleton & Midgley, 1997;

Zimmerman & Schunk, 1989). Fredricks et al. (2004) found students who endorsed mastery goals were more likely to use deep-level strategies such as elaboration or organization. Additionally, Broussard and Garrison (2004) found that higher levels of mastery/learning goal orientation related to greater academic achievement in students. These results supported Pintrich's (2000) findings that students who assumed more mastery/learning goal orientation had the highest likelihood of using adaptive self-regulated learning strategies and reported higher levels of self-efficacy. Volger and Bakken (2007) explored motivation through attribution and goal theory with the results indicating goal orientation (performance goal vs. learning goal) was important. They found that performance goals had "limited effect" on motivation (p. 28). When one has previously attained the ability to perform a task successfully, specific performance goals, as opposed to vague or do your best goals, did have a positive effect. However, when the task involved learning a highly specific skill, a learning goal was more desirable (Dishon-Berkovits, 2014). Students pursuing mastery/learning goals engaged in academic work in order to improve their competence and increase their understanding of the material learned (Magi et al., 2010). Academic goals of this nature referred to acquired new knowledge, strategies, processes or procedures for successful performance on a learning task (Locke & Latham, 2007). Additionally learning, or the acquisition of knowledge assessed through performance on a test, related positively to mastery/learning achievement goals, not performance goals (Dishon-Berkovits, 2011). These results indicate the type of goal orientation is relevant as learning, not performance goals, positively influenced academic motivation.

Teaching students to set mastery/learning goals is an important instructional strategy that fosters the use of self-regulation. Giota (2006) found a positive relationship between mastery goals and more adaptive outcomes and behavioral processes of self-regulated learning - such as positive effects, persistence, interest, and utilization of effective learning strategies, including higher levels of academic achievement. Educators can better facilitate higher academic achievement by assisting students in developing learning goals, rather than performance goals (Dishon-Berkovits, 2011) which then result in increased student confidence and a heightened self-awareness as learners (Patel & Laud, 2009). Guiding students in the development and setting of learning goals is imperative.

POWER goals. The creation of goals is prevalent in the business world and many have written about the application of SMART goals. The development of SMART goals relies on the inclusion of each element identified in the acronym. However, SMART goals can be complex and difficult to write. Therefore, this proposed study sought an alternative format for use with elementary students. Day and Tosey (2011) provided this alternate format with their *well-formed outcomes* framework. Using the mnemonic POWER, these goals contain the following five elements:

P – Positive. Stated outcomes will be in the positive. For example, rather than saying *I do not want to miss five questions*, the positive form would state, *I want to answer six questions correctly*.

O – Own role. The outcomes need to be something the students make happen because of their own actions, not dependent on others. For example stating, *I will raise my hand and ask for help,* instead of, *The teacher will call on me at least twice.*

W – What specifically? This includes the students assessing their starting point and their own actions needed to achieve the outcomes. For example, a student identifying necessary resources to achieve the outcome, *I will need to study at least two hours*.

E – Evidence. This includes what the students will collect that indicates progress toward and achievement of outcomes. This evidence can be physical or sensory-based. For example, *I provided annotations around the class notes*, or *I felt calm and relaxed during the quiz*.

R – Relationship. This refers to the effect of moving towards and reaching the outcome has on a student's relationship with self and/or peers. For example, awareness of internal barriers to goal attainment, *I am feeling confused by this topic.*

Additionally, well-formed goals are to be sufficiently significant as to be motivating, but not too large to be overwhelming. Therefore, attention to goal complexity is important. To facilitate appropriate goal setting, this study will utilize the POWER goal framework when students establish learning goals during the self-assessment with goal setting process.

During the self-assessment with goal setting process, students will establish learning goals; this study purported that establishing and achieving these goals will increase academic achievement. Therefore, understanding the impact of goal setting in academia is key. Goal setting was the topic of a significant number of educational studies, primarily in the field of physical education (Chen, Chen, & Zhu, 2012; Erturan-Ilker, 2014; Holt, Kinchin, & Clarke, 2012). These studies presented information on the successful use of goals with a focus on physical improvement. However, in the academic setting goal setting is cognitive in nature.

Goals and achievement. A number of researchers have found goal setting to be effective in improving student academic achievement. Peters (2012) conducted a study on the impact of goal setting on the science achievement of eighth grade students. Peters defined goal setting as "the process of setting specific [science] tasks and strategies to master the [science] task" (p. 884). Two key findings resulted from this work, (a) students were able to acquire more content knowledge when they had the ability to recognize and act on their learning, and (b) learning can be made explicit by using self-regulation. The study focused on self-regulation as it referred to the degree to which students were active participants in their own learning and the three components that composed the iterative cycle of self-regulation. According to this research, teachers could implement this cycle specifically in the classroom as (a) goal setting (forethought), (b) attention focusing (performance), and (c) self-monitoring and assessment (self-reflection). This study provided evidence that teachers could use goal setting to teach explicitly self-regulation strategies that increase academic achievement. Additionally, Smithson (2012) found personal goal setting to be a strong motivator for increased student performance. According to Smithson, when students were personally engaged in achieving set goals, they felt intrinsically motivated. The effectiveness of intentionally teaching goal setting as an instructional strategy to yield academic gains is clear.

Goals in instruction. As students develop into agents of learning and begin to self-regulate, they need much scaffolding and a wide variety of strategies. One strategy is the use of mastery/learning goals. Therefore, ensuring they can successful set obtainable learning goals is imperative. Cheng (2011) identified specific steps in aiding elementary students with goal setting. First, teachers should help students set specific learning goals. As Lei, Wang, and Tanjia (2001) stated, these learning goals facilitated students' understanding of their own learning tasks. Furthermore, appropriately set goals direct students' attention to completing a task, can motivate them to greater effort and persistence, and can harness helpful affective responses (Day & Tosey, 2011). Second, the goal should be specific, measureable, feasible and timely. Rader (2005) found teachers could improve students' goal achievement by assisting students in implementing measures such as a deadline, formulating a plan, anticipating achievements, and encouraging and conducting self-assessment. Finally, the teacher should hold the students accountable to achieving the goal. When students actively participate in the instructional process through goal setting and exert some control over their instruction, they may feel a greater sense of commitment or sense of responsibility for school achievement (Hannafin, 2001). Goal setting is one tool to engage students in actively participate in their learning.

An individual's ability to set goals, detect discrepancies between goals and current state of mastery, to continuously and accurately monitor ongoing learning behavior, as well as to initiate regulatory processes to the benefit of task performance are included under the term of metacognition (Roebers et al., 2012). Students who can set academic goals and take steps to achieve them develop a realistic understanding of themselves as learners, become aware of their learning styles, and develop strategies to overcome weaknesses (Joseph, 2006). Metacognitive processes hold an intermediate position between general achievement goals and task-bound specific information processes activated in a given learning situation (Roebers et al., 2012). The development of self-regulation assists students in becoming independent learners who benefit from instruction and then applied the new learning to novel situations (Van Bramer, 2011).

Summary

A review of the literature developed a strong theoretical understanding of motivation and its role in learning. The review also identified limited information regarding students as responsibility agents of learning. Self-assessment and goal setting were also reviewed and the effect of self-assessment with goal setting on motivation and cognitive engagement was of key interest. Based on the readings, building self-assessment with goal setting into existing curriculum should be a goal of curriculum leadership. This change will need to be intentional and will require planning. Assisting students as they become self-assessing goal-setters is a daunting task, but one of significant importance. Motivation and cognitive engagement occurs when students gather information about learning, assess the effectiveness of learning behaviors, drawing conclusions, and make decision about future learning. The opportunity to tackle such a cognitive task must be an intentional part of the instructional plan (Van Brummelen, 2002).

CHAPTER THREE: METHODS

The purpose of this quantitative study was to determine the effects of SAGS on academic achievement and motivation of fourth grade students. Research in this area was needed to identify instructional strategies that target key components of self-regulation at different developmental periods (McClelland & Cameron, 2011) and allow teachers to foster self-regulated learning among their students (Zimmerman, 2011). This study identified a potential instructional strategy that utilizes constructs of self-regulated learning to develop students as agents of learning, specifically at the elementary level where students' cognitive development is at the concrete operational stage (Myers, 2014).

This chapter addresses the methodology employed for this study. The research design will be discussed, followed by the research questions and hypotheses examined in the study. This chapter will provide a description of the research setting and participants. Finally, measurement instruments, proposed procedures, and data analysis procedures are shared.

Design

This study employed a quasi-experimental, pretest-posttest, nonequivalent control group design to determine the effects of using SAGS on the academic achievement and motivation of fourth grade mathematics students. This design was chosen as the most appropriate as the independent variable of SAGS was manipulated and a control group was used, along with the administration of a pretest and posttest; however, random sampling and assignment of the sample were not possible (Gall et al., 2007). Similar studies (Labuhn et al, 2010; Magi et al., 2010; Peters, 2012) also employed this design. Table 1 provides a description of the study's structure, including research questions, theoretical framework, design, and data measures.

Table 1

Description of the Study's Structure

Research Question	Theoretical Framework	Research Design	Data measurement
RQ1	Self-regulation theory (Zimmerman & Schunk, 1989)	Pretest/Posttest	Fraction and Decimal Unit Assessment and Motivated Strategies for Learning Questionnaire (modified)
RQ2	Self-regulation theory	Pretest/Posttest	Fraction and Decimal Unit Assessment
RQ3	Self-regulation theory	Pretest/Posttest	Motivated Strategies for Learning Questionnaire (modified)

Research Questions

The research questions for this study were:

RQ1: Is there a statistically significant difference between the academic achievement and motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, while controlling for the pretests?

RQ2: Is there a statistically significant difference between the academic achievement posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the Fraction and Decimals Unit Assessment, while controlling for the pretest?

RQ3: Is there a statistically significant difference between the motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the MSLQ (modified), while controlling for the pretest?

Null Hypotheses

Alternatively, the following were the null hypotheses:

$H_0$1: There is no statistically significant difference between the academic achievement and motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, while controlling for the pretests.

$H_0$2: There is no statistically significant difference between the academic achievement posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the Fraction and Decimal Unit Assessment, while controlling for the pretest.

$H_0$3: There is no statistically significant difference between the motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the MSLQ (modified), while controlling for the pretest.

Setting and Participants

The focus of this study was the use of self-assessment with goal setting as an instructional strategy and its effect on academic achievement and motivation. Relevant to the study were its setting and participants.

Setting

Students from six intact fourth grade classes from five elementary schools located in the Archdiocese participated in the study. The Archdiocese encompassed all of Western Washington, stretching from the Canadian to the Oregon border and from the Cascade Mountains to the Pacific Ocean. According to the 2012-2013 Annual Report (Archdiocese Report, 2013), the 57 diocesan elementary schools employed 1,436 teachers to deliver a Catholic education to 15,637 elementary students. Of these students, 41% were ethnic minority students.

Parish school operating revenues for 2012/2013 totaled over $115 million. Tuition and Fees accounted for 68% of the total with the balance made up of a combination of parish, neighboring parish, and Fulcrum Foundation grants, and local fund raising and development efforts. The parish grant amounted to 17% of the school parishes' collection income.

Each of the five schools is a member of the Archdiocese's Catholic Schools. Although each school operates independently and is governed by local parishes, they all are under the guidance of the Superintendent of Catholic Schools and his five Assistant Superintendents. All five schools maintain National Catholic Educational Association (NCEA) accreditation. Each of the buildings is associated with a Catholic parish and receives direct momentary support from congregational giving. For the 2014-2015 school year, the median cost of tuition was $5,600 per child and some families received multi-child discounts. The median annual budget for the schools' was $1.6 million. Within the participating schools, 27 families received tuition assistance; however, none of the schools participated in the national lunch program so none of the families was identified as qualifying for free- or reduced-lunch. Within each building, families were required to provide a minimum of 30 hours of volunteer service and an additional $550 - $600 in fundraising. Parents were required to provide transportation to and from school on a daily basis.

The demographics of the five schools were diverse. The student population ranged from 209 in the smallest participating school to 385 students in the largest, with an average population of 257 students. Each building provided instruction from Prekindergarten to the 8th grade. Four of the buildings had only one class per each grade, while the fifth supported two classes per grade.

None of the students attending any of the schools identified as or qualified for Special Education services; however, several students within each building displayed social, behavioral, or academic concerns. Students in need received support through a variety of interventions, including after-school tutoring, Title services, English Language Learning, and Multi-Sensory Learning. Each building had adequate technology and the campuses were fully functional. In addition to core academic content areas, students received instruction in religion, library, computer, Physical Education, Music, and Art. Extracurricular activities and extended-care were available. Each building received additional support through an active parent group.

Participants

This study included a convenience sample of fourth grade mathematics students drawn from six intact classrooms. Students participated because their teacher volunteered to support the study. The study used a convenient sampling, as participants were easily accessible to the researcher due to employment by the Archdiocese and location of the research sites.

Using power analysis (Kazdin, 2003), the minimum sample size needed was 128 students (N = 128) or approximately six classrooms, three classrooms per group (n = 64). This sample size was determined using a significance level of α = .05 and power, P=.8, seeking a medium effect size, d = .5 (Cohen, 1988). To ensure an adequate number of participants, students and teachers received incentives. To elicit participation, students who assented to the study received two free dress passes that permitted them to wear attire other than the required school uniform for one day each and participating teachers received gift cards to Barnes and Noble. The minimum sample size was exceeded. Table 2 explains the demographics of the sample.

Table 2

Frequencies and Percentages of Demographic Variables of Study (N = 130)

	Total (N = 130)	
	Freq.	%
Gender		
Male	55	42.3
Female	75	57.7
Race		
Caucasian	73	56.2
African	11	8.5
Hispanic	5	3.8
Pacific Islander	11	8.5
Asian	12	9.2
More than One Race	18	13.8
Math Support Services		
Yes	26	20.0
No	104	80.0

Note. Demographic information contained in this table is further disaggregated by group in Chapter 4, Table 9

The sample consisted of 130 participants (N = 130) divided into two groups, control (n = 66) and intervention (n = 64). Within the sample, none of the students had been retained or skipped a grade. The mean Total Mathematics score on the IOWA standardized test was the 57th percentile, with a median at the 60th percentile and a range of from the 1st percentile to the 99th percentile, with scores for two participants not available due to absenteeism. All students were enrolled in parish schools located within the Archdiocese. As previously stated, the students participated in the study because their teacher volunteered to support the study.

Solicitation of Support

During the Archdiocesan teacher *Day of Excellence* held on October 3, 2014, the researcher solicited teacher participation. After the researcher shared a brief verbal introduction of the study to all fourth grade teachers in attendance, she invited those individuals who were interesting in having their students participate in the study to share contact information. Sixteen interested teachers provided their emails.

Three weeks following the presentation, the researcher sent follow-up emails to those teachers who expressed an interest. Seven teachers responded with the desire to have their students participate. After secondary contact, one teacher withdrew her interest; therefore, the study consisted of six teachers and the students in their classrooms. The teachers' mean years of total teaching experience was eight years, four months, with a median of seven years, six months, and a range of 17 years. Of this total experience, the minimum number of years teaching fourth grade was one year and the maximum was 15 years. Two of the teachers described their teaching philosophy as traditionalism, while the other four identified with a constructivist approach. All of the teachers (n = 6) identified ReThink Mathematics! as their primary curriculum, with supplemental materials provided by Scott Foresman-Addison Wesley's Mathematics (n = 4), Houghton Mifflin-Harcourt's Math in Focus (n = 1), and Harcourt's Math (n = 1) programs.

Each teacher, representing her class, was placed in either the control or the intervention group. Since two teachers were employed in one building, thus creating the possible threat of experimental diffusion, the researcher grouped the teachers by building names and then randomly assigned them to groups. This ensured the placement of both teachers from the same building were in either the intervention or the control group. Names were placed into an electronic random name generator. One at a time, the generator presented a building's name; the researcher placed the first generated name in the control group, the second name in the intervention group, and so on. Buildings A, C, and E were placed in the control group, while buildings B, D, and F were placed in the intervention group. As one building had two classrooms participating, the researcher identified these classes as B and D, with class D being identified at the same time as class B.

To ensure student anonymity, the researcher assigned each class an alphabetic descriptor (A – F), and each teacher assigned each student within the class a numeric descriptor (1 – 30). These descriptors were combined (e.g., A15) and used for identification purposes only. The researcher knew each student by the combination of alphabetic and numeric descriptor only. Individual teachers only knew the alphabetic and numeric descriptors of the individual participants in their class.

After receiving IRB approval on April 22, 2015 (see Appendix A), the researcher met with teachers of both the control and intervention group on Saturday, April 25, 2015. The Procedures section details this meeting.

Even though the intervention was planned to be incorporated as part of the regular mathematics curriculum during the Fraction and Decimal unit of study, the researcher hosted an evening meeting for families at each participating building to share the instructional aspects and impacts of the study. During these meetings, the researcher shared an overview of the study with parents and students and teachers gained their consent and assent. The researcher held family meetings with class F on Monday, April 27, 2015, at 6 PM; classes B and D (combined) on Tuesday, April 28, 2015, at 7 PM; and classes A and C on Wednesday, April 29, 2015, at 5 PM and 7 PM respectfully. The teacher of class E requested no family meeting; therefore, only information using the recruitment letter (see Appendix B) and consent and assent forms were provided to families. During the meetings, the researcher followed an agenda and shared a copy of the study's abstract, the *Talking Points* handout, and the appropriate required consent and assent forms. A period for questions and answers was provided at the end of each session. Although the researcher did not document exact questions, two reoccurring themes of questions emerged. Families wished clarification on a) the effect of the Fraction and Decimal Unit assessment on their child's mathematics grade, and b) the process of ensuring their child's anonymity. To alleviate concerns, the researcher reiterated both the grading and coding processes. The researcher explained the score on the Fraction and Decimal Unit posttest was indicative of student understanding and application of mathematical concepts covered during the instructional unit; therefore, teachers could use the score as part of the grading process. The researcher also reviewed the alphabetic-numeric descriptor system, clarifying the limited knowledge of specific students by the researcher. The researcher invited 137 students to participate in the study. Three students opted out and four students had incomplete data; thus the study sample included data for 130 participants (N = 130), or 94.8% of those invited.

Curriculum

The mathematics unit selected for this study originated from the ReThink Mathematics! Common Core Unit Planning Guide (Volk, 2012). This guide divided the fourth grade mathematics Common Core State Standards into six units spanning the course of a school year. The academic focus for the duration of the study was on Unit 4, instruction on fractions and decimals. The unit focus was:

> Students develop understanding of fractions and equivalence with fractions. They recognize that two different fractions can be equal (e.g. 15/9 = 5/3) and they develop methods for generating and recognizing equivalent fractions. Students understand decimal notation for fractions, and compare decimals and fractions. (Volk, 2012, p. 12)

The unit sought to answer the essential question: *How are decimals and fractions related?* The key concepts of the unit included equivalence, ordering and comparing fractions, and an introduction of fractions with the denominators of 2, 3, 4, 5, 6, 8, 10, 12, and 100. Common Core State Standards mathematical practice standards imbedded within the unit included:

PS1. Make sense of problems and persevere in solving them

PS2. Reason abstractly and quantitatively

PS3. Construct viable arguments and critique the reasoning of others

PS4. Model with mathematics

PS5. Use appropriate tools strategically

PS6. Attend to precision

PS7. Look for and make use of structure

PS8. Look for and express regularity in repeated reasoning.

Additionally, the unit addressed several key instructional standards on fractions and decimals (see Appendix C). In addition to the unit guide, supplemental materials were provided from chapters 13 and 14 in an adopted mathematics basal curriculum, Math Connects (Altieri et al., 2009). Both the control and intervention group covered the same instructional material.

Self-Assessment with Goal Setting

In addition to the traditional instruction, the intervention group received instruction in self-assessment with goal setting based on the POWER goal framework described in the literature. The SAGS process was made concrete through the use of a worksheet and served as the independent variable. After receiving permission from the publisher to modify the work of Stiggins et al. (2006), (see Appendix D), the researcher created the worksheet. The worksheet contained three parts: Parts I and II related to the self-regulation metacognitive process of self-evaluation, while Part III related to process of setting goals. Part I was a listing of learning targets presented on the pre- and posttest. These targets represented the aforementioned instruction standards; however, the researcher rephrased the standards into student friendly language. Using the results on the pretest, students calibrated their learning by self-assessing responses as either correct or incorrect; if incorrect, students assessed as if simple error or lack of learning. Calibration refers to the degree to which students' judgments about their capability or performance actually represents their competence (Labuhn et al., 2010). Part II consisted of two short response questions: "*What am I good at?"* and "*What do I need to work on*?" Part IIIA consisted of the goal-setting frame, where students answered the question, "*What should I do next?"* (Stiggins et al., 2006). After independently completing Parts I, II, and IIIA, students participated in goal setting conferences in student partnerships/pairs with teacher monitoring. Feedback from an external source (peers) provided learners with information about how well they were performing; this feedback enhances self-reflection that results in self-evaluative judgments (Labuhn et al., 2010). Based on the self-evaluation and conference, each student completed Part IIIB and established two learning (mastery) goals for the up-coming unit of study. The teacher collected and reviewed the worksheets. The teacher provided written feedback on each student's goal form related to the selected goals, initiating a feedback loop, and then returned the forms to the students. Teachers periodically reviewed goals with students throughout the unit. Using the lens of self-regulated learning theory, the researcher developed the worksheet and its activities (see Table 3).

Table 3

Application of Self-regulation Theory to Self-assessment with Goal Setting

Constructs of Theory	Activity	Instrument
Metacognitive process of self-evaluation	Using the results on the pretest, students self-assess their responses as either correct or incorrect (if incorrect, assess if simple error or lack of learning).	SAGS, Part I
Metacognitive process of self-evaluation	Students respond to two short response questions: *What am I good at?* and What *do I need to work on?*	SAGS, Part II
Metacognitive process of goal setting	Students answer the question, *What should I do next?* and establish two learning goals	SAGS, Part IIIA
Process of responding to feedback (Feedback Loop)	Students engage in peer conferences to discuss goals. The teacher provides written feedback on each student's goal form and returns it to the student.	SAGS, Part IIIB

Instructional Classroom and Testing

The testing environment consisted of six classroom settings. The classrooms were traditional in nature, consisting of one teacher in charge of a single group of students. Students received all of their academic instruction from this teacher and remained in the same classroom throughout the day. In each class, students were administered both the pre-and posttests. All assessments, pre-identified with student descriptor codes, were distributed to students for independent completion. There was no time limit for test completion. The teacher collected the assessments upon their completion. For approximately the next six weeks, students received mathematics instruction on concepts related to fractions and decimals. At the conclusion of instruction, students took the posttests. All instruction and assessment took place during students' regularly scheduled mathematics class time.

Instrumentation

To gather data, the researcher employed several instruments. These instruments measured academic achievement and level of motivation. An assessment evaluating established learning standards of fractions and decimals determined academic achievement. A student self-report survey gauged motivation.

Fraction and Decimal Unit Assessment

The dependent variable of academic achievement and corresponding pretest covariate were measured using the Fraction and Decimal Unit Assessment. This unit was just one component of the fourth grade mathematics curriculum. Although some students participated in summative standardized assessments at the beginning of the school year, assessing mastery of the previous year's learning outcomes, there was no end-of-unit assessment currently designed to measure mastery of learning standards covered in independent units. Therefore, the researcher created an instrument aligned with the learning standards for the unit to be used to measure academic achievement. After gaining permission from the publishers (see Appendices G and H), questions for this assessment were drawn from Math Connects (Altieri et al., 2009) chapters 13 and 14 supplemental assessment resource materials, along with benchmark measures from ReThink Mathematics! (Volk, 2012) assessment tool. The researcher selected only questions aligned with the fourth grade learning standards and relevant to the unit of study.

The ReThink Mathematics! Common Core Unit Planning Guide (Volk, 2012) provided a foundation of learning standards taught at fourth grade. In addition to this resource, the Archdiocese had adopted a basal textbook published by McMillian/McGraw-Hill (Altieri et al., 2009). Certain components of this basal series aligned with the unit-planning guide; therefore, the basal provided resource materials for supplemental use by teachers and students. The series' assessment resources contained hundreds of questions in a variety of formats (multiple choice, short response, and extended response) used to measure levels of content mastery on fractions and decimals.

To create the unit assessment, the researcher copied all questions from the various testing forms of Chapter 13 (Describe and Compare Fractions) and Chapter 14 (Use Place Value to Represent Decimals). Additionally, questions from the ReThink Mathematics! (Volk, 2012) math assessments were also included. The researcher reviewed each question. If the question aligned to a fourth grade instructional standard in ReThink Mathematics! Unit 4 (see Appendix C), the question was retained; if the question did not assess an instructional standard, it was discarded. The researcher reviewed 236 questions and 178 were retained. Once all appropriate questions were identified, the researcher sorted the questions into groups based on the format (multiple choice, short response, extended response, other). The researcher retained questions in the multiple choice and short response formats; all other formatted questions were discarded. The researcher regrouped the remaining 73 questions into piles that matched Unit 4 instructional standards. At least two multiple choice and short response formatted questions were randomly selected from the piles to correspond with each instructional standard. There were five instructional standards, with four questions each, resulting in 20 questions. The unit of study emphasized certain aspects of content over others; therefore, the researcher selected additional questions to mimic the emphasis placed on content during instruction. For example, the unit emphasized the instruction of equivalent fractions; therefore, additional questions measuring equivalence were included. To facilitate ease of review, the developed question bank contained 30 questions.

The principle function of any assessment instrument used in educational research is to infer student capacities and offer information on which decisions are based (Boopathiraj & Chellamani, 2013). To ensure the selected questions accurately reflected the standards they intended to assess, a panel of five expert judges reviewed the generated questions to ensure content and construct validity and coverage of the aforementioned learning targets (Warner, 2013). The researcher provided an online survey and electronic version of the assessment to the expert reviewers. In response to the survey questions, all five reviewers indicated they were practicing educators holding a Master's degree in an educational field - one each in Administration and Supervision, Mathematics, and Special Education, and two in Curriculum and Instruction – and all maintained valid teaching certification and presently teach in Washington State. Four of the experts indicated their teaching experience fell between 11 and 20 years, with the fourth indicating 21+ years of educational service. All five had experience teaching fourth grade and at the time of the study, each was currently teaching mathematics for a minimum of 200 minutes per week.

To establish face and content validity, the survey asked reviewers to respond to two open-ended questions for each of the proposed assessment items. Since the survey was hosted online, the reviewers typed their responses in provided paragraph allowed textboxes. The open-ended question textboxes asked: *Does this question assess the construct it purports to assess?*, and *If not, how would you reword the statement or answer choices?* Reviewers were required to answer the first question for an item's consideration for inclusion on the assessment. In order to analyze systematically the written communication, the researcher performed content analysis using a feedback sheet.

After analysis of the experts' responses, the researcher either retained or discarded items from the question bank. Retained questions received approval from at least 80% of the experts, with the exception of question 17. Although this question only received approval from 60% of the reviewers, reviewers recommended the researcher reword and simplify the question to meet the standard. Therefore, the researcher reworked the original question and the newly revised question was included. The Fractions and Decimal Unit Assessment was comprised of retained items. The selected response test plan (Stiggins et al., 2006; see Table 4), illustrates the assessment's balance on each instructional standard. As greater emphasis during instruction was placed on comparing fractions, more assessment items were assigned to assess this concept. The resulting test contained 25 questions, 15 multiple choice and 10 open response, with each question having equal weight (1 point each). The teachers scored the test as total points, 0 to 25. To determine the raw score, the teacher counted the number of correct responses. Sample questions included "Find the value of x: 4/x = 16/32", "Solve. 3/10 + 4/100 ="; and "Sally wrote 3/8 on the board. Write an equivalent fraction to 3/8."

As this assessment was used to measure academic achievement, content-related validity was extremely pertinent (Gall et al., 2007). Teachers administered the assessment to entire classes simultaneously and it had no time limit. The classroom teacher conducted the scoring based on the scoring guide received during training. Further, to ensure inter-item reliability, the researcher conducted Cronbach's alpha on pretest data collected from the sample and the instrument was found to be highly reliable (25 items; $\alpha = .85$). Thus, this assessment was both valid and reliable and deemed appropriate to measure academic achievement; therefore, it was utilized as the pretest and posttest measure of such.

Table 4

Selected Response Test Plan for Fraction and Decimal Unit Assessment

	Question Format		
Learning Standard	Multiple choice	Short response	Total
Explain why a fraction a/b is equivalent to a fraction (n x a)/(n x b) by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.	3	3	6
Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as ½. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparison of fractions with symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.	4	2	6
Express a fraction with denominator 10 as an equivalent fraction with denominator of 100, and use this technique to add two fractions with respective denominators 10 and 100. For example express 3/10 as 30/100, and add 3/10 + 4/100 = 34/100. (Note: Students who can generate equivalent fractions can develop strategies for adding fractions with unlike denominators in general. However, addition and subtraction with unlike denominators in general is not a requirement at this grade.)	2	1	3
Use decimal notation for fractions with denominators 10 or 100. For example, rewrite 0.62 as 62/100; describe a length as 0.62 meters; locate 0.62 on a number line diagram.	3	1	4
Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual model.	3	3	6
TOTAL	15	10	25

Motivated Strategies for Learning Questionnaire (modified)

The dependent variable of motivation and corresponding pretest covariate were measured using a modified version of the Motivated Strategies for Learning Questionnaire (Pintrich et al., 1991), MSLQ (modified). The authors originally designed this self-report measure to assess college students' motivational orientation and use of different learning strategies within a college course based on a cognitive view of motivation and learning (Pintrich et al., 1991). The original MSLQ resulted from research in the areas of teaching and learning and has been deemed an appropriate instrument to measure motivation (Gable, 1998) and existed in the public domain of the internet. A statement granting permission to use it for valid research purposes, as long as the researcher cited the instrument appropriately in writings and publications, was provided on the University of Michigan's School of Education website (2014). Additionally, the researcher obtained written permission to use a modified version of the MSLQ via email (see Appendix H).

Modifications to the original instrument have been used successfully with elementary students (Metallidou & Vlachou, 2010; Milner et al., 2011). Extensive use in research supported the content validity of the MSLQ (Duncan & McKeachie, 2005; Milner et al., 2011). The MSLQ has been used to assess the motivational and cognitive effects of different aspects of instruction, including instructional strategies, on students (Metallidou & Vlachou, 2010) and as a tool to measure several aspects of motivation related to learning, including goal orientation and self-efficacy (Pintrich & DeGroot, 1990). The reliability of the original MSLQ was acceptable; the majority of Cronbach's alphas were robust ($\alpha > .70$) indicating the subscales had good internal validity. Zero-order correlations between the different scales were also robust and suggested that the scales were valid measures of the motivational and cognitive constructs (Pintrich et al., 1991). This study utilized a modified version of the MSLQ. For the purpose of this study, the researcher modified the language on the MSLQ to be more appropriate for fourth graders. For instance, the word *class* substituted the word *course*. The questionnaire was administered via paper-pencil, took approximately 30 minutes to complete, and was hand scored.

The MSLQ (modified) instrument for this study included 41 questions from the Motivation and Learning Strategies scales and their subscales. Since the instrument was designed to be modular (Duncan & McKeachie, 2005), and in an effort to be cognizant of length of instrument, only subscales deemed applicable to this study were selected. The Motivation scale consisted of subscales from the value component (including intrinsic goal orientation, task value, and control of learning beliefs) and the expectancy component (including control of learning beliefs and self-efficacy for learning and performance). The Learning Strategies scale consisted of components from the cognitive and metacognitive strategies subscales (including critical thinking and metacognitive self-regulation) and the component of resource management strategies (effort regulation).

Intentionally, the developed instrument did not include certain subscales. From the Motivation scale value component subscale, the researcher excluded the extrinsic goal orientation because it concerned the degree to which a student perceived his or her participation in a task for extrinsic motivators such as grades, rewards, performance and competition. The focus of this study was intrinsic motivation; therefore, this scale was not appropriate. The instrument did not include the affective component (test anxiety subscale). Although test anxiety relates negatively to expectancies and achievement, this topic was beyond the scope of this study, therefore the researcher excluded this component. From the cognitive and metacognitive strategies component of the Learning Strategies scale, the subscales of rehearsal, elaboration, and organization were excluded. Rehearsal and elaboration refer to strategies that help students store information in memory; memory was beyond the scope of this study. Organization included strategies such as clustering, outlining, and selecting main ideas. At the fourth grade level, organization is guided and not independent; therefore, it was excluded. Finally, the Learning Strategies scale component of resource management (including the subscales of time and study environment, effort regulation, peer learning, and help seeking) was excluded from the study. The subscales measured student management and regulation of their time and study environment. As the self-assessment with goal setting process took place during the school day, with limited impact on students' learning environment beyond the school walls, these questions were deemed unnecessary for the scope of this study. Additional modifications included the use of a 5-point Likert-type scale, as opposed to the original 7-point scale, with responses ranging from 1 (*not at all true*) to 5 (*always true*). Table 5 illustrates item dispersion of the MSLQ (modified) scales and subscales.

The researcher conducted the scoring using Microsoft Excel® and consisted of computing a total Motivation score by adding the scores from the two scales, Motivation and Learning Strategies. Scores for each scale were computed by adding scores from each subscale. Subscale scores were computed by adding the students' responses on each question within the subscale domain and finding the average. Four questions in the learning strategies scale were reverse-worded (questions 23, 31, 36, and 37) and their responses were transformed prior to scoring. Sample questions included, *"In math, I like material that really challenges me so I can learn new things," "I am very interested in what I am learning in math," "I expect to do well in math,"* and *"When the math is hard, I give up or only study the easy parts"* (REVERSED). The teacher administered the assessment to entire classes simultaneously and it had no time limit. Table 6 provides a description of each instrument and highlights key components.

Table 5

MSLQ (modified) Scales and Subscales Item Dispersion

Scale/Subscale	Item numbers on instrument	Total
Motivation		**20**
Intrinsic goal orientation	2, 3, 6, 7	4
Task value	5, 8, 9, 14, 16	5
Control of learning beliefs	4, 10, 17, 18	4
Self-efficacy for learning and performance	1, 11, 12, 13, 15, 19, 20	7
Learning strategies		**21**
Critical thinking	22, 24, 25, 30, 32	5
Metacognitive self-regulation	21, 26, 27, 29, 31, 33, 34, 35, 36, 39, 40, 41	12
Effort regulation	23, 28, 37, 38	4
Total Number of Items		**41**

To determine reliability of MSLQ (modified), Cronbach's alpha coefficient was calculated. Cronbach's alpha is the most popular form of reliability assessment for multiple-item scales (Warner, 2013). Internal consistency should achieve at least an acceptable level, $\alpha > .70$, based on George and Mallory's interpretive guide (Rovai et al., 2014). The MSLQ (modified) was found to be highly reliable (41 items; $\alpha = .91$), as were the scales of motivation (20 items; $\alpha = .90$) and learning strategies (21 items; $\alpha = .88$). There results were consistent with previous research indicating the scales of the original MSLQ achieved acceptable levels of internal consistency (Pintrich et al., 1991).

Table 6

Descriptions of Instruments

	Fraction and Decimal Unit Assessment	Motivated Strategies for Learning Questionnaire (modified)
Description	Teacher developed unit assessment on identified learning targets	Student self-report questionnaire
Purpose	To assess students' comprehension and application of identified fraction and decimal learning targets.	To assess students' motivational orientations and use of different learning styles for a math class.
Variable measured	Academic achievement	Motivation
Assessment format	Multiple choice and short answer	Likert-type scale
Validity	Expert reviewers	Previous research
Reliability	Cronbach's α = .85	Cronbach's α = .91

Procedures

The researcher obtained approval to conduct the study within the Archdiocese by direct contact with the Superintendent of Catholic Schools. The researcher held a meeting with the out-going Superintendent of Catholic Schools mid-September 2014. During this meeting, the researcher presented an overview of the proposed study and made a request to introduce the study to teachers at the *Day of Excellence*, scheduled for October 3, 2014. After receiving verbal permission from the Superintendent, the researcher shared an overview of the study with all fourth grade teachers attending the *Day of Excellence*, solicited participation, and requested contact emails from those interest. After this initial contact, 16 teachers indicated a willingness to participate. An incoming Superintendent took over the position on October 1, 2014. The researcher held a meeting with the new Superintendent mid-January 2015. During this meeting, the researcher presented an overview of the proposed study, shared the previous Superintendent's sponsorship, and requested the new Superintendent's support to conduct the study within the Archdiocese. The Superintendent granted verbal approval during the meeting and followed the conversation with an email confirming his backing. After submitting the dissertation proposal packet and gaining Institutional Review Board (IRB) approval (see Appendix A), the study commenced. The researcher contacted participating teachers and calendared training and family meeting nights.

The researcher met with participating classroom teachers the weekend prior to the study's implementation to review aspects of the study and to provide training. Training consisted of two segments. The initial 70-minute training occurred for both the control and intervention group teachers and consisted of a review of mathematical content, explicit instruction on testing procedures, and coding for confidentiality and study identification. Teachers received explanation on how the activities for the intervention group differed from the control group and the components that remained the same. Additionally, the researcher shared the expectations of the mathematics content to be covered and delivery of instruction. During the training, teachers received the binder entitled *Guide to Research*. The binder contained a copy of the researcher's contact information, the pacing guide, the Fraction and Decimal Unit Assessment and its accompanying scoring guide, a copy of the MSLQ (modified) and its scoring guide, the free dress passes for the students, and the envelope for returning consent and assent forms. Beginning with the pacing guide (see Appendix H), the researcher progressed through the binder by tabbed content. The researcher first reviewed the Fraction and Decimal Unit Assessment and allowed for necessary discussion on rationale or clarification. The researcher shared the process of determining student scores. Teachers then received training on the MSLQ (modified). The instrument and its User's Guide were reviewed. A brief overview of each scale and subscale, and the components of motivation they measured, were discussed. After reviewing these two sections, the researcher explained procedures for administration, along with the process of coding for student identification. Each teacher received a script to follow during administration of instruments. The researcher also detailed procedures for collection of completed materials. Time for discussion was provided and any questions or concerns were answered and resolved.

At the conclusion of these initial 70 minutes of training, the researcher released control group teachers, while teachers of the intervention group received 80 minutes of additional explicit training. This training focused on the use of the SAGS process and the researcher distributed an additional section of the binder containing a copy of the instrument and its accompanying user's guide. After review of the written materials, the researcher modeled the process of using SAGS and teachers participated in guided practice. This training period also provided opportunity to ask clarifying questions and to resolve any issues. At the conclusion of the question and answer session, the training session concluded.

Next, the researcher conducted the Family Nights. The researcher scheduled these voluntary family nights at the teachers' home schools to meet with families from each class. To encourage family attendance, the event included a light snack. During each meeting, the researcher described the study and provided an opportunity for questions and answers. At the conclusion of the meeting, the researcher left the meeting and the teacher distributed and collected guardian consent and student assent forms. If families were unable to attend, teachers sent home consent and assent forms and families returned these forms directly to the teachers.

All returned forms were placed in a large envelope and sealed prior to returning to the researcher. Teachers indicated returned forms on a checklist affixed to the front of the envelope.

During the family night, the researcher shared the study's implementation with families. The researcher explained the implementation of the study occurred during mathematics instruction over the course of approximately six weeks and would cause very limited disruption to established instructional routines. If a student opted out of the study, his or her data was excluded from the analysis; this included only three students, B16, E03, and F11. All students in participating classes enjoyed all aspects of the mathematics lessons, as these activities were considered educationally appropriate and part of existing curriculum and educational routines.

During the six-week duration of the study, the researcher was available to the teachers via phone or email if any questions or concerns arose. During weeks one and five, the researcher initiated email contact with teachers to offer encouragement and review status. After the study concluded, control group teachers were invited to receive the additional 80 minutes of explicit instruction afforded the intervention group teachers. Two teachers accepted the invitation, and training was held in August 2015.

The study commenced when teachers administered the Fraction and Decimal Unit Assessment pretest. The next day, teachers administered the MSLQ (modified) pretest. These pretests were printed on yellow paper, indicating they were not intended for grading purposes (posttests were printed on white paper). Student descriptor codes identified all assessments and once distributed, students completed these independently. After students completed the Fraction and Decimal Unit Assessment pretest and prior to day three, teachers scored the assessment. On day three, teachers in the control group began their instruction on the mathematic content covered in Unit 4, following the lesson guide; however, teachers in the intervention group began the treatment.

Teachers in the intervention group redistributed the scored Fraction and Decimal Unit Assessment pretests. Over the course of the next two days, teachers guided students through the process of self-assessment with goal setting, using the SAGS tool and guidelines received during training. After day four, teachers in the intervention group commenced their instruction on mathematic content covered in Unit 4. To ensure treatment-treatment fidelity, the researcher made spontaneous visits on May 13, 2015, and May 14, 2015, to the intervention sights during implementation of the experiment.

Over the course of the next six weeks, both groups received mathematics instruction daily for a minimum of 45 minutes. Additionally, the intervention group implemented self-assessment with goal setting over two extra days. Furthermore, randomly throughout the unit, teachers of the intervention group reminded students of their established personal learning goals during the daily instruction. After about six weeks, both groups were at the conclusion of Unit 4. Once teachers provide all instruction, they administered the Fraction and Decimal Unit Assessment and MSLQ (modified) posttests (copied on white paper) over the course of two days. All assessment administration protocols from the pretest were repeated at this stage. Again, the teachers administered the Fraction and Decimal Unit Assessment first and the MSLQ (modified) second.

At the conclusion of the study, the researcher met with each teacher to gather the study materials. Once the researcher received all data from the participating teacher, the Barnes and Noble gift card was dispensed. After review of the materials, the researcher discarded any materials collected from students who opted out of the study (B16, E03, and F11). Additionally, the researcher discarded materials from students A17, F02, F04, and F14 due to significant incomplete data points. Therefore, the study's sample included data from 130 participants (*N* = 130) of the invited 137 students, or 94.8% of possible participants.

Data were collected at two intervals during the study, once at the beginning of the study and once at the conclusion of the unit of study or treatment period. Collected data were pre- and posttest on the academic achievement and motivation measures. Scores on pretest achievement assessment were determined as a raw score based on the number of correct responses. The same procedures occurred for the posttest. The researcher used a Microsoft Excel® spreadsheet to determine the pretest mean scores on the MSLQ (modified). The same procedures occurred for the posttest.

Once all data were collected and reviewed, the researcher began data entry. Demographic information was entered first. To create a data file, demographic variables were created. For each case, the researcher coded group, student descriptor, gender, ethnicity, support service, and IOWA percentile score (see Appendix I). This file was saved as *Demographics*. The researcher created a second data file and saved it as *RawScores*. For each case, the researcher coded variables for group, student descriptor, and each question item on the MSLQ (modified) and Fraction and Decimal Unit Assessment pre- and posttests (see Appendix J). Each response was directly recorded from participants' worksheets.

Since four of the items on the motivation measure were reverse worded, the researcher created a copy of the *RawScores* data file and renamed it *RecodedRawScores*. Using the SPSS® Statistics Standard GradPack v.19 transform function, case responses for the four variables on the pretest (PM23, PM31, PM36, and PM37), along with the four variables on the posttest (M23, M31, M36, and M37), were recoded into same variable as 1 for 5, 2 for 4, 4 for 2, and 5 for 1. This file was exported into Microsoft Excel® to calculate pre- and posttest mean scores for academic achievement, as measured by the Fraction and Decimal Unit Assessment, and motivation, as measured by the MSLQ (modified). Once calculated using Microsoft Excel®, mean scores were entered into a SPSS® v.19 file named *MeanScores*. All data analyses were run from this file. It contained 10 variables and 130 cases as defined in Table 7.

Table 7

MeanScores Variable Descriptions

Variable	Construct	Value	Measure
group	Identifies placement within Control or Intervention Group	1 = Control 2 = Intervention	Nominal
stud_descriptor	Individual participant alpha-numeric descriptor	None	Nominal
PreMSLQ	Mean score on the motivation pretest measure; sum total of scores from the Motivation and Learning Strategies scales	None	
PreM	Mean score on the Motivation scale	None	Scale
PreLS	Mean score on the Learning Strategies Scale	None	Scale
PostMSLQ	Mean score on the motivation posttest measure; sum total of scores from the Motivation and Learning Strategies scales	None	Scale
PostM	Mean score on the Motivation scale	None	Scale
PostLS	Mean score on the Learning Strategies Scale	None	Scale
PreFDU	Mean score on the academic achievement pretest measure	None	Scale
PostFDU	Mean score on the academic achievement posttest measure	None	Scale

Data Analysis

For this quasi-experimental, pretest-posted, nonequivalent control group designed study, several statistical analyses were conducted. All analyses employed SPSS® v.19 software. For all analyses in the study, a $p < .05$ level of significance was used to determine if the null hypotheses could be rejected. Confidence limits were set at 95 percent. The effect size was calculated using the partial eta-squared (η_P^2) statistic and interpreted based on Cohen's convention (1988).

As explained previously, a power analysis indicated the minimum sample size of 128 students or 64 students per group. This sample size was determined using a significance level of $\alpha = .05$ and power, $P = .8$, and sought a medium effect size, $d = .5$ (Kazdin, 2003). The sample size for the study was sufficient. A summary of proposed statistical analysis for each hypothesis is presented in Table 8.

Table 8

Proposed Statistical Analysis for Each Hypothesis

Hypothesis	Independent variable	Dependent variable(s)	Statistical analysis
$H_0$1	Self-assessment with goal setting	Academic achievement and motivation, separate	MANCOVA
$H_0$2	Self-assessment with goal setting	Academic achievement	ANCOVA
$H_0$3	Self-assessment with goal setting	Motivation	ANCOVA

Proposed statistical procedures of the study included MANCOVA to test Null Hypothesis 1, ANCOVA to test Null Hypothesis 2, and ANCOVA to test Null Hypothesis 3. This study analyzed the effects of the independent variable on the combination of academic achievement and motivation, as well as the effect on each independently.

Prior to hypotheses testing, data from the pretests were analyzed using SPSS® v.19. A pretest was necessary in this study as the control and intervention groups needed to be examined for equality as group selection was not random and groups may have had preexisting differences (Campbell & Stanley, 1963). Separate one-way between subjects analysis of variances (ANOVAs) were performed to test if the intervention and control groups in academic achievement as measured by Fraction and Decimal Unit Assessment, or motivation as measured by the MSLQ (modified), were equivalent. Results from the academic achievement ANOVA indicated significant differences between the two groups on the pretest, suggesting the pretest be used as a covariate. Results from the motivation ANOVA indicated no significant differences between the two groups on the pretest, suggesting the pretest was not needed as a covariate. However, Pearson's chi-square tests indicated significant differences among groups in ethnicity proportions; thus, the pretests were used as a covariate to control for these existing differences.

Furthermore, to assess the degree of correlation between academic achievement and motivation, a Pearson product-moment correlation test was conducted on the posttest results to evaluate the relationship between academic achievement and motivation. The linear combination of academic achievement and motivation was not established as results indicated no significant relationship existed between academic achievement and motivation; therefore, academic achievement and motivation were deemed separate dependent variables throughout the study.

As a result of violations in assumption testing that an association existed between academic achievement and motivation, no analysis was conducted to test research question one's null hypothesis (H01), there was no statistically significant difference between the academic achievement and motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, while controlling for the pretests. The proposed MANCOVA was not appropriate even though a hypothesis of difference between groups was suggested, with one independent variable (SAGS) containing two groups (control and intervention), two dependent variables (academic achievement and motivation), and a covariate was present (pretest) (Rovai et al., 2014). Rather, it was determined that two separate ANCOVAs to test null hypotheses two and three were appropriate.

Prior to analyzing statistical results of the ANCOVAs, certain key assumptions and requirements were tested in order for the statistical analyses to be interpreted appropriately (Gall et al., 2007; Kazdin, 2003; Rovai et al., 2014; Warner, 2013). These assumptions included independence of observations, outliners, normality, linearity, homogeneity of variance, homoscedasticity, and homogeneity of regressions of slopes.

Since groups were independent of each other and no participant was in both the control and intervention group, the assumption of independence of observations was met. To inspect visually for extreme outliers, boxplots were generated for both dependent variable constructs of academic achievement and motivation, as well as the covariates of the Fraction and Decimal Unit Assessment and MSLQ (modified) pretests. The boxplots indicated that none of the variables contained extreme outliers. The variables were standardized to check for the presence of extreme outliers (z-score of +/- 3.0), and none were noted. Therefore, it was determined that all cases would be retained for analysis and that the assumption of absence of extreme outliers was met for all variables.

Normality for the scores of the two dependent variables and two covariate variable constructs were tested. The Kolmogorov-Smirnov test was used to assess normality for each variable at each level. This test is appropriate due to the sample size ($N > 50$) (Rovai et al., 2014). The results of the K-S test with the Lilliefors significance correction indicated that the sample did not follow a normal distribution. Therefore, additional tools to assess normality were reviewed. A further investigation of normality via descriptive statistics of skewness for each variable and covariate, followed with a visual inspection of histograms for each variable and covariate, were conducted. Both identified a mild negative skew for the variable of motivation and its covariate and for the academic achievement variable. The covariate of academic achievement had a mild positive skew. Further comparison of the mean, 5% trimmed mean, and median relating to each variable and covariate indicated numbers close in value on each. Therefore, a light departure from normality was assumed. Since many parametric procedures, including ANCOVAs, are robust in the face of light to moderate departures from normality (Rovai et al, 2014), the researcher made no data transformations and continued with the planned analyses.

The assumption of linearity between variables was addressed through a visual inspection of scatterplots and statistical analyses. When disaggregated by group, the correlation between the Fraction and Decimal Unit Assessment pretest and posttest scores indicate a strong positive relationship and between the MSLQ (modified) pretest and posttest scores indicated a very strong positive relationship. Linear relationships did exist between the dependent variables and their respective covariates; thus, the assumption of linearity was tenable.

Using SPSS®v. 19, the assumption of homogeneity of variances was examined with Levene's test. Levene's test provided evidence that the variance in academic achievement and motivation posttests were not significant and the assumption of equal variance was tenable. To test the assumption of homoscedasticity, or that the variability in scores for academic achievement and motivation were roughly the same for both the control and intervention group, scatter plots were generated and visually inspected. Results indicated groups had similar variances and the assumption of homoscedasticity was satisfied.

To examine the assumption of homogeneity of regression slopes, or whether there was an interaction between group placement and the covariates, two preliminary ANCOVAs were conducted with a custom model that included a *group x covariate* interaction term. The interaction for academic achievement was not statistically significant; nor was the interaction for motivation. These results indicated no significant violation of the assumption of homogeneity of regression slopes.

To test research question two's (RQ2) null hypothesis (H_02), there was no statistically significant difference between the academic achievement posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the Fraction and Decimal Unit Assessment, while controlling for the pretest, a one-way between subjects ANCOVA was conducted. This analysis was appropriate since a hypothesis of difference between groups was tested, with one independent variable containing two groups (control and intervention), one dependent variable (academic achievement), which was continuous and normally distributed, the data are independent, and a covariate was present (pretest) (Rovai et al., 2014).

To test research question three's (RQ3) null hypothesis (H_03), there was no statistically significant difference between the motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the MSLQ (modified), while controlling for the pretest, one-way between subjects ANCOVA was conducted. This analysis was appropriate since a hypothesis of difference between groups was tested, with one independent variable containing two groups (control and intervention), one dependent variable (motivation), which was continuous and normally distributed, the data are independent, and a covariate was present (pretest) (Rovai et al., 2014).

The following information will be reported in Chapter Four: null hypothesis that is being evaluated, descriptive statistics, statistical tests used, results of evaluation of test assumptions, and test results.

CHAPTER FOUR: FINDINGS

The purpose of this quasi-experimental, pretest-posttest, nonequivalent control group study was to apply the theory of self-regulation (Zimmerman & Schunk, 1989) by measuring the effect of SAGS on academic achievement and student motivation, while controlling for the pretests, for fourth grade math students attending five Archdiocesan elementary schools in the Pacific Northwest. The research questions and corresponding null hypotheses were assessed using the ANCOVA procedures. The following chapter presents the findings. The results are divided into five sections (a) research questions, (b) null hypotheses, (c) descriptive statistics, (d) results, and (e) summary.

Research Questions

This study examined self-assessment with goal setting as an instructional strategy. Furthermore, the study intended to investigate the impact of the strategy on academic achievement and motivation. Specifically, the research questions for this study were:

RQ1: Is there a statistically significant difference between the academic achievement and motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, while controlling for the pretests?

RQ2: Is there a statistically significant difference between the academic achievement posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the Fraction and Decimals Unit Assessment, while controlling for the pretest?

RQ3: Is there a statistically significant difference between the motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the MSLQ (modified), while controlling for the pretest?

Hypotheses

Alternatively, the following were the null hypotheses:

$H_0$1: There is no statistically significant difference between the academic achievement and motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, while controlling for the pretests.

$H_0$2: There is no statistically significant difference between the academic achievement posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the Fraction and Decimal Unit Assessment, while controlling for the pretest.

$H_0$3: There is no statistically significant difference between the motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the MSLQ (modified), while controlling for the pretest.

Descriptive Statistics

Sample Population and Demographics

This study included a convenience sample of fourth grade mathematics students drawn from six intact classrooms within a large Archdiocese in the Pacific Northwest. The sample consisted of 130 students, of which 55 (42.3%) were males and 75 (57.7%) were females. The students were almost equally distributed between the control (n = 66) and intervention (n = 64) groups. A 6 x 2 Pearson χ^2 contingency table analysis was conducted to evaluate proportions of ethnicity within groups. The two variables were ethnicity (Caucasian = 73, African American = 11, Hispanic = 5, Pacific Islander = 11, Asian = 12, More than One Race = 18) and group placement (control = 66, intervention = 64), N = 130. The analysis was significant, χ^2 (5, N = 130) = 12.34, p = .03, Cramer's V = .31, p = .03. Therefore, ethnicities were not proportionally dispersed among groups. Participants identified as Caucasian were overly present in the intervention group (67%) compared to the control group (45%). The control group had very few participants identified as Hispanic (1.5%), yet a large number of participants identified as More than One Race (21.2%). Table 9 presents the frequency and percentages of the participants' demographics disaggregated by group placement.

As groups were intact at the beginning of the study, redistribution of participants to generate homogeneity in areas such as ethnicity was not an option; therefore, including the use of pretests as part of the study design was used to control for preexisting differences.

Table 9

Frequencies and Percentages of Demographic Variables of Study Disaggregated By Group Placement (N = 130)

	Control Group (*n* = 66)		Intervention Group (*n* = 64)		Total (*N* = 130)	
	Freq.	%	Freq.	%	Freq.	%
Gender						
Male	29	43.9	26	40.6	55	42.3
Female	37	56.1	38	59.4	75	57.7
Race						
Caucasian	30	45.5	43	67.2	73	56.2
African	8	12.1	3	4.7	11	8.5
Hispanic	1	1.5	4	6.3	5	3.8
Pacific Islander	6	9.1	5	7.8	11	8.5
Asian	7	10.6	5	7.8	12	9.2
More than One Race	14	21.2	4	6.3	18	13.8
Math Support Services						
Yes	12	18.2	14	21.9	26	20.0
No	54	81.8	50	78.1	104	80.0

Instrumentation and Descriptives

The study employed two instruments. To measure academic achievement, the study used the researcher-designed, expert validated Fraction and Decimal Unit Assessment. To measure motivation, the study used the MSLQ (modified) (Pintrich et al., 1991).

Fraction and Decimal Unit Assessment. For this study, the Fraction and Decimal Unit Assessment served as the instrument used to assess participants' academic achievement. The exact same instrument was given as both a pretest and posttest. The assessment consisted of 25 questions in two formats, multiple choice (15 questions) and short answer (10 questions). A reliability analysis was conducted on the 25 items hypothesized to assess academic achievement and the overall Cronbach's coefficient ($\alpha = .85$) indicated a relatively high internal consistency. This study used raw scores obtained from the measure. Possible scores ranged from 0 – 25, with higher scores indicative of higher levels of academic achievement. Academic achievement, as represented by the Fraction and Decimal Unit Assessment posttest scores, was used as a dependent variable in Hypotheses 1 and 2. Pretest scores on the Fraction and Decimal Unit Assessment were used as the covariate. Table 10 presents the measures of central tendencies and the variability for each group for pretest and posttest scores on academic achievement as measured by the Fraction and Decimal Unit Assessment. Also shown are the adjusted and unadjusted marginal means and the associated standard errors for the estimated marginal means of academic achievement as measured by the Fraction and Decimal Unit Assessment posttest scores. Figure 1 presents a graphical representation of the mean pretest and posttest academic achievement scores as measured by the Fraction and Decimal Unit Assessment for each group. The intervention group showed a higher growth percentage pretest to posttest compared to the control group.

Table 10

Measures of Central Tendency and Variability for Academic Achievement, with Adjusted and Unadjusted Marginal Means and Standard Error (N = 130)

	Pretest				Posttest				Posttest Adjusted	
Group	*M*	*SD*	*Mdn*	*Range*	*M*	*SD*	*Mdn*	*Range*	M_{ADJ}	SE_{ADJ}
Control (*n* = 66)	14.17	5.53	12.0	19.0	18.83	5.24	19.5	19.0	18.26	0.43
Intervention (*n* = 64)	12.47	4.56	12.5	20.0	20.56	3.98	21.0	14.0	21.00	0.44

Note. *M* = Mean; *SD* = Standard Deviation; *Mdn* = Median; M_{ADJ} = Adjusted Mean; SE_{ADJ} = Adjusted Standard Error

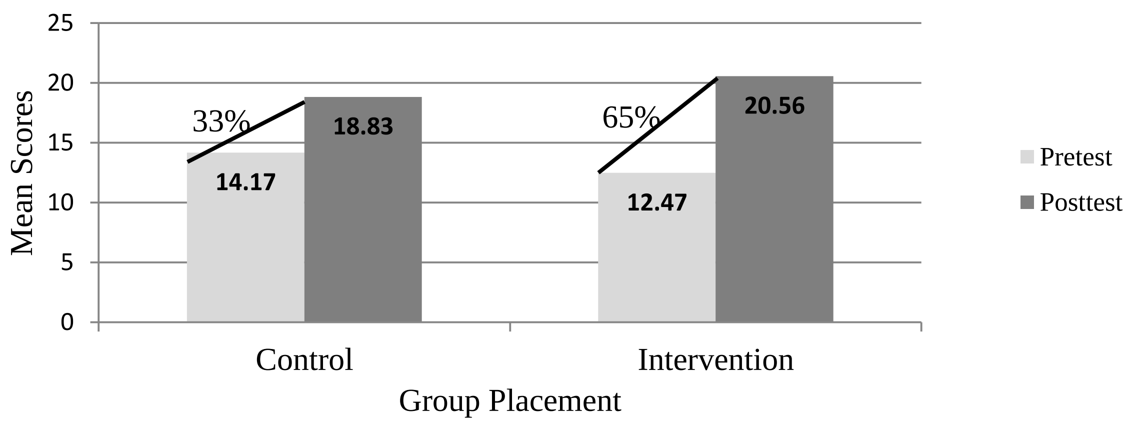

Figure 1. Growth percent for academic achievement.

MSLQ (modified). To assess the level of participants' motivation, this study employed the MSLQ (modified) as both a pretest and posttest measure. This instrument included 41 questions from the motivation and learning strategies scales and their subscales. The motivation scale consisted of subscales from the value component (including intrinsic goal orientation, task value, and control of learning beliefs) and the expectancy component (including control of learning beliefs and self-efficacy for learning and performance). The learning strategies scale consisted of components from the cognitive and metacognitive strategies subscales (including critical thinking and metacognitive self-regulation) and the component of resource management strategies (effort regulation). The overall Cronbach's coefficient ($\alpha = .91$) for the present sample indicated a relatively high internal consistency. Scores could range from the lowest possible 7 to the highest possible 35, with higher scores indicating higher levels of motivation. The levels of motivation as measured by the MSLQ (modified) posttest scores were used as a dependent variable in Hypotheses 1 and 3. The MSLQ (modified) pretest scores were used as the covariate. Table 11 presents the measures of central tendencies and the variability for each group for pretest and posttest levels of motivation, as measured by the MSLQ (modified) scores. Table 11 also shows the adjusted and unadjusted marginal means and the associated standard errors for the estimated marginal means of the levels of motivation, as measured by the MSLQ (modified) posttest scores.

Figure 2 presents a graphical representation of the mean pretest and posttest levels of motivation, as measured by the MSLQ (modified) scores, for each group. The intervention group showed an extremely small growth percentage pretest to posttest, while the control group showed a negative growth percentage indicating participants scored their motivation as lower on the posttest compared to the pretest.

Table 11

Measures of Central Tendency and Variability for MSLQ (modified), with Adjusted and Unadjusted Marginal Means and Standard Error (N = 130)

	Pretest				Posttest				Posttest Adjusted	
Group	*M*	*SD*	*Mdn*	*Range*	*M*	*SD*	*Mdn*	*Range*	M_{ADJ}	SE_{ADJ}
Control (*n* = 66)	25.71	3.45	26.35	15.78	25.27	3.79	25.79	16.43	25.15	0.26
Intervention (*n* = 64)	25.44	4.19	26.04	17.44	25.79	4.46	26.05	21.12	25.91	0.26

Note. *M* = Mean; *SD* = Standard Deviation; *Mdn* = Median; M_{ADJ} = Adjusted Mean; SE_{ADJ} = Adjusted Standard Error

Results

Statistical procedures of the study included no analysis to evaluate Null Hypothesis 1 and ANCOVAs to test Null Hypotheses 2 and 3. A visual inspection of the scatterplot between the dependent variables of academic achievement and motivation showed no discernable relationship. The correlation between these dependent variables indicated no significant linear relationship, $r(130) = .03$, $p = .73$ (two tailed). All descriptive and inferential analyses employed SPSS® v.19 software. For all inferential analyses of the hypotheses addressing the research questions of the study, a significance level of $p < .05$ was used to determine if the null hypotheses could be rejected. Confidence limits were set at 95 percent. The effect size was calculated using the partial eta-squared (η_P^2) statistic and interpreted based on Cohen's convention (1988). Prior to conducting statistical analyses, certain assumptions were assessed to ensure the analyses could be used appropriately (Gall et al., 2007; Kazdin, 2003; Rovai et al., 2014; Warner, 2013). These assumptions included independence of observations, no significant outliners, normality, linearity, homogeneity of variances, homoscedasticity, and homogeneity of regression slopes.

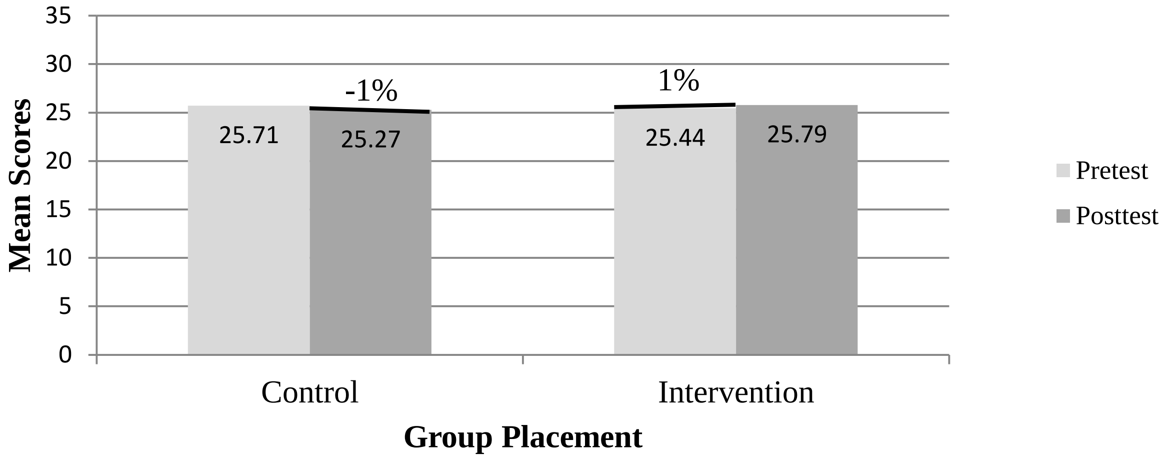

Figure 2. Growth percent for MSLQ (modified) assessment.

Since groups were independent of each other and no participant was in both the control and intervention group, the assumption of independence of observations was met. Boxplots were generated to inspect visually for extreme outliers for both dependent variable constructs of academic achievement and motivation, as well as the covariate pretests. The boxplots indicated that none of the control or dependent variables contained extreme outliers. The variables were standardized to check for the presence of extreme outliers (z-score of +/- 3.0), and none were noted. Therefore, it was determined that all cases would be retained for analysis and that the assumption of absence of extreme outliers was met for all variables.

Normality for the scores of the two dependent variables and two covariate variable constructs were tested. The Kolmogorov-Smirnov (K-S) test was used to assess normality for each variable by group. This test is appropriate due to the sample size of the control group (n = 66) and the intervention group (n = 64) (Rovai et al., 2014). The results of the K-S test with the Lilliefors significance correction indicated non-normal distributions for the academic achievement dependent variable for both the control group, D (66) = .17, p < .001, and the intervention group, D(64) = .15, p = .001, as well as for the academic achievement covariate control group, $D(66) = .17$, $p < .001$, and the motivation covariate control group, $D(66) = .11$, $p = .04$. Normal distributions were found for the academic achievement covariate intervention group, $D(64) = .08$, $p = .20$, the motivation covariate intervention group, $D(64) = .10$, $p =.20$, and the motivation dependent variable for both the control group, $D(66) = .09$, $p = .20$, and the intervention group, $D(64) = .09$, $p = .20$. Since normality tests are conservative, additional tools to assess normality were reviewed. A further investigation of normality was conducted via descriptive statistics of skewness for each variable and covariate, followed by a visual inspection of histograms for each variable and covariate. Both identified a mild negative skew for the variable of motivation, its covariate, and for the academic achievement variable. The covariate of academic achievement had a mild positive skew. Further comparison of the mean, 5% trimmed mean, and median relating to each variable and covariate by group (see Table 12) indicated numbers close in value on each. Mean scores on the academic achievement pretest (control: $M = 14.17$, $SD = 5.53$, $n = 66$; intervention: $M = 12.47$, $SD = 4.56$, $n = 64$) did not differ significantly across groups, $F(1,128) = 3.64$, $p = .06$; nor did the mean scores on the motivation pretest (control: $M = 25.71$, $SD = 3.45$, $n = 66$; intervention: $M = 25.44$, $SD = 4.19$, $n = 64$), $F(1,128) = .16$, $p = .69$, indicating the assumption of normality was met. Since many parametric procedures, including ANCOVAs, are robust in the face of light to moderate departures from normality (Rovai et al, 2014), the researcher made no data transformations and continued with the planned analyses.

Table 12

Comparison of Means, Trimmed Means, and Medians

	Control Group			Intervention Group		
Variable Construct	*M*	Trimmed *M*	*Mdn*	*M*	Trimmed *M*	*Mdn*
Motivation						
Pretest (covariate)	25.71	25.79	26.35	25.44	25.61	26.04
Posttest	25.27	25.41	25.80	25.79	25.86	26.05
Academic Achievement						
Pretest (covariate)	14.17	14.11	12.00	12.47	12.22	12.50
Posttest	18.83	19.06	19.50	20.56	20.83	21.00

Note. *M* = Mean; Trimmed Mean at 5%; *Mdn* = Median

The assumption of linearity between variables was addressed through a visual inspection of scatterplots and statistical analyses. Visual inspections of the scatterplots between pretest and posttest scores for each dependent variable disaggregate by group indicated linear relationships. The correlation between academic achievement pretest and posttest scores as measured by the Fraction and Decimal Unit Assessment indicated moderate positive relationships for both the control group, $r(66) = .61$, $p < .001$ (two tailed) and the intervention group, r(64) = .57, p < .001 (two tailed). The correlation between the motivation pretest and posttest scores as measured by the MSLQ (modified) indicated very strong positive relationships for both the control group, $r(66) = .88$, $p < .001$ (two tailed), and the intervention group, $r(64) = .86$, $p < .001$ (two tailed). These analyses indicated the assumption of linearity was tenable.

Using SPSS®v.19, the assumption of homogeneity of variances was examined with Levene's test. Levene's test provided evidence that the variance in academic achievement posttests, $F(1,128) = .39$, $p = .54$, was not significant; nor was the Levene's test for motivation posttests, $F(1,128) = .76$, $p = .39$, and the assumption of equal variance was tenable. To test the assumption of homoscedasticity, or that the variability in scores for academic achievement and motivation were roughly the same for both the control and intervention group, scatter plots were generated and visually inspected. Results indicated groups had similar variances and the assumption of homoscedasticity was satisfied.

To assess the assumption of homogeneity of regression slopes, or whether there was an interaction between group placement and the covariates, two preliminary ANCOVAs were conducted with a custom model that included a *group x covariate* interaction term. The interaction for academic achievement was not statistically significant, $F(1,126) = 2.48$, $p = .12$; nor was the interaction for motivation, $F(1,126) = .00$, $p = .99$. These results indicated no significant violation to the assumption of homogeneity of regression slopes.

After all assumptions were examined, statistical analyses to test the null hypotheses commenced. Two one-way ANCOVAs were used to test two of the three research questions and null hypotheses in this study.

Hypothesis Testing for Research Question 1

Since the assumption of association between the dependent variables, as noted above, for a MANCOVA was not tenable, a one-way between subjects MANCOVA was not appropriate. A MANCOVA was not used to evaluate research question one's null hypothesis ($H_0 1$) that there was no statistically significant difference between the academic achievement and motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, while controlling for the pretests.

Hypothesis Testing for Research Question 2

To test research question two's null hypothesis ($H_0 2$), there was no statistically significant difference between the academic achievement posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the Fraction and Decimal Unit Assessment, while controlling for the pretest, an one-way between subjects ANCOVA was conducted. The dependent variable was academic achievement represented by the Fraction and Decimal Unit Assessment posttest scores. Group placement acted as the independent variable (fixed factor). The academic achievement pretest score acted as the covariate. A significance level of $p < .05$ and confidence level of 95% were set.

The results of the ANCOVA showed that the effect of group placement (control, intervention) on academic achievement was significant, $F(1, 126) = 19.73$, $p < .001$, a medium effect size ($\eta_P^2 = .14$), and observed power $P = 1.00$. Consequently, there was a significant effect on academic achievement dependent on group placement. While the control group's pretest academic achievement scores were higher than the intervention group's pretest scores, the intervention group's posttest academic achievement scores ($M = 20.56$, $SD = 3.98$) were higher than the control group's scores ($M = 18.83$, $SD = 5.24$).

Conclusions Related to Research Question 2

There was a statistically significant difference between the academic achievement posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, while controlling for the pretest. Therefore, analyses provided evidence to reject Null Hypothesis 2. A pairwise comparison showed this significant difference between the intervention group and control group ($MD = 2.74$, $SE = .62$, $p < .001$). An inspection of the adjusted mean scores on academic achievement demonstrated the intervention group's scores, ($M_{adj} = 21.00$, $SE = .44$, $n = 64$) were higher than that of the control group, ($M_{adj} = 18.26$, $SE = .43$, $n = 66$).

Hypothesis Testing for Research Question 3

To test research question three's null hypothesis (H_03), there was no statistically significant difference between the motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the MSLQ (modified), while controlling for the pretest, one-way between subjects ANCOVA was conducted. The dependent variable was level of motivation represented by the MSLQ (modified) posttest scores. Group placement acted as the independent variable (fixed factor). The motivation pretest scores acted as covariates. A significance level of $p < .05$ and confidence level of 95% were set.

The ANCOVA showed that the effect of group placement (control, intervention) on motivation was significant, $F(1,126) = 4.28$, $p = .04$, a small effect size ($\eta_P^2 = .03$), and observed power $P = .54$. Consequently, there was a significant effect on motivation dependent on group placement. The intervention group's posttest levels of motivation as represented by the MSLQ (modified) scores ($M = 25.79$, $SD = 4.46$) were marginally higher than the control group's levels of motivation scores ($M = 25.27$, $SD = 3.79$).

Conclusions Related to Research Question 3

There was a statistically significant difference between the motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, while controlling for the pretest. Therefore, analysis provided evidence to reject Null Hypothesis 3. An inspection of the adjusted mean scores on motivation demonstrated that the intervention group's score, ($M_{adj} = 25.91$, $SE = .26$, $n = 64$) was almost equal to that of the control group, ($M_{adj} = 25.17$, $SE = .26$, $n = 66$).

Summary

Chapter Four began with a brief review to the research questions this study addressed, along with their corresponding null hypotheses. Then, descriptive statistics were provided. These included a description of the sample population and instrumentation used for the study.

The results of analyses followed, which included the required addressing of assumptions, the inferential analyses of variable constructs, and a brief explanation of drawn conclusions.

Since a required assumption necessary to conduct a MANCOVA to examine Null Hypothesis 1 was not tenable, this analysis was not conducted. Therefore, the performed hypotheses testing were conducted using two one-way ANCOVAs. A statistically significant main effect on the academic achievement dependent on group placement was found and supported the rejection of Null Hypothesis 2. A statistically significant main effect on motivation dependent on group placement was found and there was evidence to reject Null Hypothesis 3. Thus, students who participated in the use of self-assessment with goal setting had higher mean posttest scores on academic achievement and motivation when compared to the mean posttest scores of students who did not participate in the intervention. A summary of the tested null hypotheses is provided in Table 13.

Table 13

Summary of Tested Hypotheses

Hypothesis	Statement	Test	*F*	p value	Results
$H_0 1$	There is no statistically significant difference between the academic achievement and motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, while controlling for the pretests.				Assumption Violated Not tested
$H_0 2$	There is no statistically significant difference between the academic achievement posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the Fraction and Decimal Unit Assessment, while controlling for the pretest.	ANCOVA	20.05	< .001	Reject
$H_0 3$	There is no statistically significant difference between the motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the MSLQ (modified), while controlling for the pretest.	ANCOVA	4.31	= .04	Reject

Chapter Five will discuss the study's methodology and review the results of analyses. Then, the chapter will share the implications of the study as it connects to prior research and theory. Finally, the chapter shares the limitations of the study and concludes with recommendations for future research.

CHAPTER FIVE: DISCUSSION

Chapter Five reviews this quasi-experimental, pretest-posttest, nonequivalent control group study and provides a summary of the findings. The chapter will begin with a discussion on the methodology and a review of the results of the ANOVAs and ANCOVAs. Next, the chapter will share the implications of the study as it connects to prior research and theory, as well as the practical and theoretical associations of the research. Finally, the chapter shares the limitations of the study and concludes with recommendations for future research.

Discussion

The purpose of this research study was to examine the effects of SAGS on the academic achievement and motivation of fourth grade mathematic students. The study sought to address three research questions: (1) Is there a statistically significant difference between the academic achievement and motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, while controlling for the pretests?, (2) Is there a statistically significant difference between the academic achievement posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the Fraction and Decimal Unit Assessment, while controlling for the pretest?, and (3) Is there a statistically significant difference between the motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the MSLQ (modified), while controlling for the pretest?

A review of the methodology shows a convenience sample (N = 130) of fourth grade students from six intact classrooms in a large Archdiocese within the Pacific Northwest participated in the study. The researcher placed the names of the six teachers, representing the students in each of the classrooms, randomly into either the control group (n = 66) or the intervention group (n = 64). Preliminary analysis of group ethnicity was significant, indicating ethnic composition between groups was not proportionally distributed. As groups were intact at the beginning of the study, redistribution of participants to generate homogeneity was not an option; therefore, the inclusion of pretests as part of the study design was used to control for preexisting differences (Campbell & Stanley, 1963). Teachers administered the Fraction and Decimal Unit Assessment as the pretest and posttest measure of academic achievement. Teachers also administered a the MSLQ (modified) as the pretest and posttest measure of levels of motivation. The academic achievement and motivation pretests were administered to both groups prior to the commencement of the study. After approximately six weeks of instruction and at the conclusion of the unit of study, posttests were administered to both groups. After the administration of all assessments, statistical analyses were conducted.

Conclusions

A MANCOVA was planned to test the first null hypothesis: There is no statistically significant difference between the academic achievement and motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, while controlling for the pretests. A MANCOVA is best used when the dependent variables are moderately correlated (Tabachnick & Fidell, 2007); however, testing revealed the dependent variables of academic achievement and motivation were not significantly correlated. This lack of correlation violates the assumption of linearity. Since MANCOVAs assume linear relations between dependent variables and the assumption of linearity was not tenable, the results would not be conclusive (Rovai et al., 2014). Thus, no statistical analysis was conducted on the first null hypothesis. Two separate ANCOVAs were deemed more appropriate to test the impact of SAGS on academic achievement and motivation as separate dependent variables.

An ANCOVA was conducted to test the second null hypothesis: There is no statistically significant difference between the academic achievement posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the Fraction and Decimal Unit Assessment, while controlling for the pretest. The researcher hypothesized that participation in the intervention of self-assessment with goal setting would lead to a statistically significant difference between academic achievement scores between groups as measured by the Fraction and Decimal Unit Assessment. Results indicated that a statistically significant difference in academic achievement did exist. These results provide statistical evidence in support of the inclusion of student self-assessment with goal setting into instructional routines to improve academic achievement for elementary students, as the intervention group scores were significantly higher than were those of the control group.

An ANCOVA was conducted to test the third null hypothesis: There is no statistically significant difference between the motivation posttest mean scores of fourth grade mathematics students who participated in SAGS and those who did not, as measured on the MSLQ (modified), while controlling for the pretest. The researcher hypothesized that participation in the intervention of self-assessment with goal setting would lead to a statistically significant difference between levels of motivation between groups as measured by the MSLQ (modified). Results indicated that a statistically significant difference in motivation existed. These results provide statistical evidence in support of the inclusion of student self-assessment with goal setting into instructional routines to improve levels of motivation for elementary students, as the intervention group scores were significantly higher than were those of the control group.

Relationship to Prior Research

The purpose of this quasi-experimental, pretest-posttest, nonequivalent control group study was to apply the theory of self-regulation (Zimmerman & Schunk, 1989) by measuring the effect of SAGS on academic achievement and student motivation, while controlling for the pretests, for fourth grade students at five elementary schools within the Pacific Northwest. Few studies have identified effective instructional strategies that motivate elementary students in becoming agents of learning or the effect of these strategies on academic achievement and motivation (Dignath & Buttner, 2008). Limited research surrounding the achievement and motivational effect of goal setting tied to self-assessment as an instructional strategy has emerged and rarely have studies applied goal-setting theory to academic performance and motivation (Dishon-Berkovits, 2014). This study tied both self-assessment and goal setting to academic performance and motivation. Exploring this topic allowed teachers in this study to incorporate SAGS into instructional routines, thereby supporting students in become agents of learning. The current study supplements existing research by examining the impact of SAGS as an instructional strategy on academic achievement and motivation. Results indicate SAGS has a positive impact on academic achievement and motivation, but the study was unable to test the impact on the combination of academic achievement and motivation.

Concerning the relationship between academic achievement and motivation, the results of this study were mixed. While a preponderance of prior research indicates a moderate correlation between motivation and academic achievement (Brophy, 2010; Ryan & Deci, 2000; Wigfield et al., 2004; Zimmerman & Schunk, 1989), this study did not find such a relationship. The fact that this relationship was not strong supports the findings of others who suggest the results of correlations between motivation and test results are, in fact, fairly low (Pintrich et al., 1993;

Wolters, 2004; Wolters & Pintrich, 1998). Conflicting viewpoints exist within current research and the association between motivation and achievement remains a highly studied construct. The results of this study, indicating little if any relationship between academic achievement and levels of motivation, further support the findings that motivation is not directly related to academic outcome measures.

This study does show a significant impact of the intervention of using SAGS on academic achievement. As part of the intervention, students participated in two explicit, teacher-directed concrete activities - self-assessment followed by goal setting. Results show that as the fourth grade students participated in self-assessment of academic achievement, they were able to analyze their strengths and weaknesses and establish concrete learning goals. These results extend the work of previous studies on third grade students' use of metacognitive skills (Lovett & Ravelljhh, 1990; Roebers et al., 2012) to fourth grade students. These results further support the assertion that even young students can accurately self-assess (Magi et al., 2010; Paris & Newman, 1990) and successfully calibrate their learning (Winne & Muis, 2011). Furthermore, the results support Guthrie's (1983) conclusion that students are able to diagnose needs and shortcomings when students become aware of their own learning processes and Joseph's (2006) assertion that metacognitive awareness helps students understand their role as learners and makes them cognizant of strategies for improving performance. In addition to significant positive results of the intervention of SAGS on academic achievement, it also lead to an increase in levels of motivation.

The intervention of self-assessment with goal setting did result in a statistically significant difference in participants' levels of motivation. The use of self-assessment with goal setting as an instructional strategy is motivating. These findings support the notion that, as self-determined agents of learning, students strive for the inherent satisfaction of, or intrinsic motivation, to learn. Within the confines of the study, the students were motivated to exert effort, persist in the face of difficulty, set challenging yet attainable goals, and increased their self-efficacy, as predicted by Paris and Paris (2001). These results further the work of Brophy (2010), who stated motivation to learn is finding activities meaningful and worthwhile, and Palmer (2005), who stated motivation activated and maintained learning behaviors. Additionally this study extends to elementary students the work of Rukavina et al. (2012), who reported the positive impact on student engagement toward math instruction in a motivational environment on the attitudes of college students. For participants in this study, utilizing self-assessment with goal setting while learning math created a more motivating environment than the traditional setting. Furthermore, discussion with a student after the administration of the motivation posttest indicated her increased awareness in her use of specific approaches measured by the learning strategies subscale on the MSLQ (modified). Therefore, the study's significant result may be indicative of students' increased awareness of what learning behaviors they should be employing, or their metacognitive regulation (Eker, 2014). The use of self-assessment with goal setting leads to increased motivation as measured by student responses on the MSLQ (modified).

As participants within the intervention group received instruction in designing a learning goal prior to instruction and the results indicate a positive influence on learning, this study expands previous findings by a number of researchers that goal setting is effective in improving academic achievement. Smithson (2012) found goal setting increased or maintained academic assessment scores in elementary reading and Peters (2012) found the use of self-regulation practices had a positive impact on student achievement in eighth grade science. This study expands these results to mathematics. Furthermore, this study, by the inclusion of average to above students, extends the work Gabriele (2007) who examined the influence of achievement goals and comprehension monitoring (self-evaluation) on the learning of low achieving students. Additionally, the positive academic achievement results build on Eker's (2014) evidence that students can monitor their own learning and determine whether they understand the subject or not, as well as select and apply learning strategies that were right for the time and place, thus enhancing metacognitive regulation.

This study also furthers the position metacognitive strategies can be explicitly taught. The study supports Peters' (2012) evidence that teachers could use goal setting to teach explicitly self-regulation to increase academic achievement and Cubukcu's (2009) findings that teachers play a role in ensuring students are aware of the benefits of self-regulated learning. The explicit teaching of SAGS employed in this study supports Paris and Paris' (2001) theory of academic achievement that emphasizes how other people can help children learn tactics to regulate their own behavior and learning and Dunning, Heath, and Suls (2004) assertion that interventions can be introduced to prompt students in evaluating their skill and learning more accurately.

These results show when activities are made concrete, elementary students are able to accurately reflect on their learning and their learning needs and increase their levels of motivation and academic achievement. The use of SAGS as an instructional strategy leads to higher levels of academic achievement and motivation.

Implications

The results of this research have implications that are both theoretical and practical. The results were examined through the lens of several theories and some theories are bolstered by the outcome of the study. Additionally, the study has practical implications for students, teachers, and other educational stakeholders.

Theoretical Implications

The cognitive development theory (Piaget, 1950) provided a framework for looking at self-assessment with goal setting with participants at the end of the concrete operational period. The results of study supported that when the tools used in the process of self-assessment with goal setting were presented as concrete processes aligned to Piaget's concrete operational stage, students were able to articulate their internal understandings and thinking. Therefore, the implication is self-assessment with goal setting as employed in this study is an appropriate instructional tool for learners at the elementary level.

Bandura's (1991) social cognitive theory would have predicted that self-assessment with goal setting would lead to increased motivation and academic achievement. The theory states behavior is motivated and regulated by self-influences. These influences are the self-monitoring of one's behavior (self-assessment), what determines the behavior (motivation), and the effects of the behavior (academic achievement). The study's intervention was designed specifically to address each of these influences. The results of this study show the success of the intervention to influence participants' behavior. Although the intervention allowed participants to self-monitor their behavior and observe the effects as positive learning outcomes, as well as indicate increased levels of motivation, the underlying connection between motivation and achievement remains ambiguous. The implications of these results indicate the need for further study on interventions that influence the combination of motivation and achievement.

Self-determination theory (Deci & Ryan, 1985), with its focus on social factors that affect performance and cognitive engagement, would indicate that the intervention of self-assessment with goal setting would lead to participants' cognitive engagement. Cognitive engagement draws on Fredricks et al. (2004) idea of investment, or the thoughtfulness and willingness to exert the effort necessary to comprehend and master complex and difficult ideas and skills. The results of the study indicate self-assessment with goal setting did increase participants' investment in their learning and ergo, they were engaged cognitively. The implications from the study include the importance of including the self-determination construct of cognitive engagement into instructional strategies, as does self-assessment with goal setting.

The theory of self-regulated learning (Zimmerman & Schunk, 1989) grounded this study. This theory postulates that individuals have the ability to understand and control their learning environment. The study's intervention was designed specifically to develop self-regulated learning behaviors. Results of the study show that as students analyzed tasks, set productive goals, and selected strategies to achieve the goals, self-assessment with goal setting positively influenced academic achievement and motivation in mathematics. The intervention required participants to become actively engaged in understanding and controlling their learning. As students became active participants in their own learning, they developed and strengthen self-regulated learning behaviors and advanced as agents of learning. The results of this study on the effects of self-assessment with goal setting fully support the components of self-regulated learning theory. This study adds to the literature on self-regulated learning by offering a specific instructional strategy that teachers can use to modify their classrooms and foster increases in self-regulated learning behaviors among their students.

Practical Implications

The results of this research have practical implications for students and teachers, as well as other stakeholders within the field of education. The results, specifically related to Research

Question 2 regarding academic achievement and Research Question 3 regarding motivation, provide support for the introduction of SAGS into every teacher's repertoire of instructional skills. Based on the results from the current study, students who participated in SAGS showed an improvement in mathematics achievement and motivation as compared to students who did not participate. These findings contribute to the growing evidence that self-regulated learning behaviors positively affect academic achievement and motivation and develop students as agents of learning. Although results were not obtained with regard to a relationship between academic achievement and motivation, SAGS does positively affect academic achievement and motivation separately.

This study indicates that elementary students who participate in SAGS score higher in academic achievement and levels of motivation than students who do not. Therefore, there is a practical implication for students. The SAGS, along with the accompanying template, can assist students as they develop the self-regulated learning behaviors that provide for the successful self-management of learning. Students can use the SAGS template as a concrete example to follow as they cultivate their own learning behaviors. The template provides students the opportunity to practice independently self-regulated learning skills. The template used in this study was designed in a concrete manner specifically to assist younger students as they developed their skills. As students progress and mature, they can modify and adjust self-assessment and goal setting to broaden their skill set.

The study also has practical implications for teachers. With the national trend moving toward student accountability and the need for effective instructional strategies, this study provides statistical evidence of an instructional strategy that works. It is important for teachers to understand that self-assessment with goal setting prompts students to self-regulate their learning and enhances students' academic achievement and motivation. This intervention assists teachers in modifying their classrooms to foster self-regulated learning; the intervention's design targets key components of self-regulation specifically for the elementary level. Given the results of this study, it is clear that teachers should provide explicit instruction on the use of self-regulating strategies, specifically the use of SAGS. This instructional strategy should become standard in every teacher's repertoire.

This decree leads to implications for other stakeholders. As the goal of many school districts is to create life-long learners, helping students develop the skills necessary to achieve in this endeavor is paramount. To assist students in becoming life-long learners, stakeholders must provide teachers and students with time. In the educational setting of today, time is a valuable resource. Policy makers need to allocate time within the hurried instructional pace to permit students and teachers opportunities to apply the instructional strategy highlighted in this study and develop additional interventions that mirror SAGS. This will be time well spent, as the study's results suggest students who engage in SAGS have the ability to influence their learning and motivation, and achieve at a higher level.

Results of this study provide statistical evidence that students who participate in SAGS achieve higher academically and motivationally. SAGS provides an instructional strategy that optimizes self-regulated learning processes in a concrete manner for students in the mid to late concrete operational cognitive stage and should be a part of every school's instructional program.

Limitations

For this quasi-experimental, pretest-posttest, non-equivalent control group study, the researcher sought to limit the threats to internal and external validity. Through research design, this study attempted to account for such threats; however, the limitations and assumptions need to be recognized.

Several limitations existed in this study. Selection was one limitation of this study (Rovai et al., 2014). The potential for non-equivalent groups presented an internal threat to validity; therefore, the researcher employed a pretest-posttest design. The study called for the administration of pretests to all participants to aid in controlling for lack of randomization (Campbell & Stanley, 1963) and to meet the assumption of equivalence. To determine group equivalency, the researcher conducted an ANOVA on pretest scores (Dix, 2013). ANOVA was used to assess statistically whether the means of the groups were significantly different (Rovai et al., 2014). Since the groups were significantly different, the final analysis included the pretests as covariates, allowing for the statistical equalizing of the groups. The ANCOVA controlled for group differences on the posttest that could be due to pre-existing group differences rather than the intervention effect (Warner, 2013). Additionally, the use of a pretest-posttest study design minimized the threats of history, maturation, instrumentation and experimental mortality (Campbell & Stanley, 1963).

Testing was another limitation of the study. Since the design called for the use of pretesting, exposure to the pretest could have affected the results of the posttest. The use of a control group addressed this threat since the reactive effects were present in both groups (Labuhn, et al., 2010; Smithson, 2012). The use of a pretest also presented sensitization as a limitation. Although a pretest was a key component of this study, sensitization was limited, as the design called for the administration of a pretest to both the control group and intervention group. Therefore, any pretest affects presented in both groups.

Self-report bias presents as a limitation of the study. The use of the MSLQ (modified) as a self-report instrument to measure motivation within this study allows for discrepancy between what is reported and what students actually do in the classroom, as indicated by Rotgans and Schmidt (2012). Since students had no previously experience using the MSLQ (modified), the novelty of the tool may have also led to inaccuracies in self-measurement. Dunning et al. (2004) contend when students self-evaluate, they tend to be overconfident in newly learned skills and seem largely unable to assess accurately. The importance of self-reports, as a research tool, has already been established in early childhood research (Magi et al., 2010). Although self-report items are least reliable form of measurement (Rovai et al., 2014), there were no procedures for determining the truthfulness of students' responses, therefore their responses were assumed to be valid (Warner, 2013).

Population validity may have been a limitation of this study. The study consisted of an isolated intervention on experimentally accessible population; therefore generalizations of results were limited (Gall et al., 2007). It was assumed that the sample population was representative of all fourth grade mathematics students in the Pacific Northwest; however, this may not have been the case. To negate this external threat of validity, researchers would need to conduct further studies to determine generalizability.

Implementation may have been another limitation of this study; it was possible that participants in the intervention and control groups received different treatment, thereby creating differing experiences (Rovai et al., 2014). However, it was assumed that all instructional content provided to both groups was equivalent, providing fidelity. To ensure fidelity, the researcher provided explicit teacher training and instructed teachers to follow the lesson-planning guide, thus providing equivalent instruction to both groups. Teacher non-compliance with the prescribed research guidelines may have added to the threat of implementation. It was assumed that teachers correctly followed guidelines presented during training with regard to administering and scoring of assessments. Additionally, it was assumed the teachers in the intervention group followed the procedures of implementation of SAGS with fidelity. Researcher-initiated email contact throughout the treatment period alleviated this concern. In addition, teachers from both groups received explicit training on procedures prior to the commencement of the study.

Finally, the threat of experimental treatment diffusion, when communication occurs between groups, was possible (Rovai et al., 2014). To eliminate this threat, the researcher ensured she assigned all teachers housed in the same building to either the intervention group or control group. This provided limited opportunity for diffusion, as all teachers housed in the same building participated in the same group. Additionally, the researcher asked all participating teachers to have limited communication between each other during the treatment period. Furthermore, the confines of this study provided ecological validity of explicit description of the experimental intervention (Rovai et al., 2014). The appendices include copies of forms used during instruction of the intervention. Furthermore, a robust sample size ($N > 128$), with sufficient group sizes ($n>64$), enhanced internal and external validity of this study as determined by power analysis (Kazdin, 2003).

Recommendations for Future Research

Future investigations regarding the effectiveness of SAGS to support elementary students is necessary to continue to provide important information aiding the development of self-regulated learning behaviors. Future research could include an intensified study of motivation, its subscales, and the independent activities of self-assessment and goal setting.

As indicated in the theoretical implications section, a clearer understanding of the impact of SAGS on self-influences that affect the combination of academic achievement and motivation is needed. Therefore, future studies may be designed to hone in on these self-influences and directly measure the effects of SAGS on them. Additionally, the limited length of time for this study may have resulted in the small effect of SAGS on motivation. This study was limited to one attempt at SAGS for the duration of one unit of study. It is possible that repeated uses of SAGS over the course of multiple units of study would yield a more significant impact on motivation. Thus, future studies with repeated use of SAGS with an expanded amount of time between pretest and posttest measures of motivation are needed. It is also recommended that future studies examine motivation’s multiple constructs.

At the outset of this study, academic achievement and motivation were assumed to be moderately correlated. This assumption influenced the study’s design. Results of this study did not support such a correlation and, with the current conflicting research about the existence of such a correlation, future examination is needed to determine if and how motivation is linked to academic achievement. This current study supported the assertion that teaching self-regulating behaviors (self-assessment with goal setting) can lead to higher levels of academic achievement and motivation as separate constructs. However, a deeper understanding of the relationship between these behaviors and the combination of academic achievement and motivation is needed. Direct instruction can aid in the acquisition of self-regulating learning behaviors that help develop students who are truly agents of their own learning, yet it remains unclear if these behaviors can also result in high levels of motivation in combination with academic achievement. Therefore, future studies can seek to address two questions: Does motivation lead to the development of self-regulating behaviors that lead to higher levels of achievement or do the behaviors lead to higher achievement and increased motivation? and Can students have high levels of motivation, yet lack the self-regulating behaviors that lead to higher levels of academic achievement? Motivation, as studied in this research, was viewed as a single construct comprised of two subscales – Motivation and Learning Strategies. Some research suggests that certain subscales of motivation are more highly correlated to achievement than are others (Pintrich & DeGroot, 1990; Rotgans & Schmidt, 2012; Wolters, 1998). In this study, the impact of SAGS on each subscale was not explored. Therefore, future research aimed at the impact of SAGS on each subscale of motivation is appropriate.

Along similar lines, this study combined two separate activities into a single intervention. The independent variable in this study was the use of self-assessment *with* goal setting. Results indicated that students who participated in this combined activity scored higher in academic achievement and levels of motivation. Although the results were significant for the combined activity, this study did not examine if self-assessment or goal setting in isolation would affect achievement. Therefore, future research is needed to examine the intervention activities of self-assessment and goal setting independently.

Summary

The purpose of this study was to determine the effect of student use of SAGS on fourth grade mathematics students' academic achievement and motivation. Results indicated the assumed correlation between academic achievement and motivation was not statistically evident. The researcher hypothesized that participation in the intervention of SAGS would lead to a statistically significant difference in academic achievement and motivation scores between participants in the control group compared to the intervention group. Results indicated that a statistically significant difference in academic achievement and motivation as separate constructs did exist.

These results provide statistical evidence in support of the inclusion of student use SAGS into instructional routines to improve academic achievement and increase levels of motivation. While this study supports the use of SAGS as an instructional strategy, more investigation is still needed to identify strategies that foster the development of self-regulated learning and support students in becoming agents of learning.

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APPENDIX A: IRB Approval Letter

IRB Approval 2173.042215: The Effects of Student Self-Assessment with Goal Setting on Fourth-Grade Mathematics Students: Creating Self-Regulating Agents of Learning

IRB, IRB <IRB@liberty.edu>

Wed 4/22/2015 10:58 AM

Personal

To: Clift, Laura <lclift@liberty.edu>;

Cc: IRB, IRB <IRB@liberty.edu>; Garzon, Fernando (Ctr for Counseling & Family Studies) <fgarzon@liberty.edu>; Collins, Gail L (School of Education) <glcollins2@liberty.edu>;

1 attachment (2 MB)

ChangeinProtocol.docx;

Dear Laura,

We are pleased to inform you that your above study has been approved by the Liberty IRB. This approval is extended to you for one year from the date provided above with your protocol number. If data collection proceeds past one year, or if you make changes in the methodology as it pertains to human subjects, you must submit an appropriate update form to the IRB. The forms for these cases are attached to your approval email.

Your IRB-approved, stamped consent forms are also attached. These forms should be copied and used to gain the consent of your research participants. If you plan to provide your consent information electronically, the contents of the attached consent documents should be made available without alteration.

Please retain this letter for your records. Also, if you are conducting research as part of the requirements for a master's thesis or doctoral dissertation, this approval letter should be included as an appendix to your completed thesis or dissertation.

Thank you for your cooperation with the IRB, and we wish you well with your research project.

Sincerely,

Fernando Garzon, Psy.D.
Professor, IRB Chair
Counseling

(434) 592-4054

APPENDIX B: Recruitment Letter

About the Study!

Dear Families:

As a graduate student in the Curriculum and Instruction Department in the School of Education at Liberty University, I am conducting research as part of the requirements for a doctoral degree. The purpose of my research is to test self-assessment with goal setting's (SAGS) effect on academic achievement and student motivation for fourth grade students at several schools within the [redacted]. This topic may assist teachers in applying the teaching tool of self-assessment with goal setting into their instructional routines. I am writing to invite your child to participate in my study.

If you are willing to allow your child to participate, your child will be asked to complete a questionnaire that focuses on strategies that motivate his or her learning twice during the study, once at the beginning of the study and once at the end of the study. This questionnaire will take about 30 minutes to complete each time. Your child will also be asked to complete the Fraction and Decimal Unit Assessment twice during the study, once at the beginning of the study as a pretest and once at the end of the study as a posttest. This assessment will take about 45 minutes to complete each time.

Your child's participation will be completely anonymous, and no personal, identifying information will be required.

For your child to participate, complete and return the attached consent document to your child's teacher. The consent document contains additional information about my research. Your child's participation is voluntary. If you give permission for your child to participate in my study, please complete the consent form and return it to your child's teacher.

If you choose to allow your child to participate, he or she will receive two free dress passes.

Sincerely,

Laura Dvornick Clift

Thank you!

APPENDIX C: Fourth Grade Instructional Standards

Standard	Practice Standards
Explain why a fraction a/b is equivalent to a fraction (n x a)/(n x b) by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.	PS.2 PS.4
Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as ½. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparison of fractions with symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.	PS.2 PS.4
Express a fraction with denominator 10 as an equivalent fraction with denominator of 100, and use this technique to add two fractions with respective denominators 10 and 100. For example express 3/10 as 30/100, and add 3/10 + 4/100 = 34/100. (Note: Students who can generate equivalent fractions can develop strategies for adding fractions with unlike denominators in general. However, addition and subtraction with unlike denominators in general is not a requirement at this grade.)	PS.2 PS.4
Use decimal notation for fractions with denominators 10 or 100. For example, rewrite 0.62 as 62/100; describe a length as 0.62 meters; locate 0.62 on a number line diagram.	PS.6
Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual model.	PS.2 PS.4

APPENDIX D: Permission to Use SAGS Worksheet

+ Font Size -

FW: Request to use information

From : Laura Clift [redacted] Tue, Mar 10, 2015 12:03 PM

Subject : FW: Request to use information 3 attachments

To : laura clift [redacted]

Laura Dvornick Clift, Teacher

[redacted]

"Inspiring Excellence"

From: Lewis, Vineta [mailto:vineta.lewis@pearson.com]
Sent: Tuesday, March 10, 2015 11:07 AM
To: Laura Clift
Subject: Fwd: Request to use information

Hello Ms. Clift,

Thank you for this message.

You have our permission to adapt the requested content for use in as a tool in your quantitative study investigating the effect of student self-assessment with goal setting.

Please credit the authors, full title and publisher, Pearson Education, Inc., New York, NY.

Sincerely,
Vineta
Vineta Lewis
Permissions Supervisor
Pearson Education
200 Old Tappan Road
Old Tappan, NJ 07675
Phone 201-236-3281
Fax 201-236-3290

---------- Forwarded message ----------
From: **Laura Clift** [redacted]
Date: Tue, Feb 3, 2015 at 8:19 PM
Subject: Request to use information
To: "ati-info@pearson.com" <ati-info@pearson.com>

Good evening:

My name is Laura Clift and I am a doctoral student from Liberty University located in Lynchburg, Virginia. My doctoral dissertation is on the effects of self-assessment with goal setting on student academic achievement and motivation. I have attached a copy of my abstract for your review.

I am writing to request permission to use an intervention tool generated after reading the book Classroom Assessment for Student Learning (Stiggins, Arter, Chappuis, & Chappuis, 2006). Specifically, I would like to use a modified version of Figure 5.13a "Student Documentation of Selected Response Test Results" (p. 161) combined with information about goal setting (Chapter 13). I have attached my intervention form (SAGS worksheet) for your review.

I am seeking written permission to use this tool. I look forward to your favorable reply. Please do not hesitate to contact me with any questions or concerns.

Respectfully,

Laura Clift

Laura Dvornick Clift, Teacher

[redacted]

"Inspiring Excellence"

APPENDIX E: Permission from Math Connects Publisher

From: Lewis, Vineta [mailto:vineta.lewis@pearson.com]
Sent: Tuesday, March 10, 2015 11:07 AM
To: Laura Clift
Subject: Fwd: Request to use information

Hello Ms. Clift,

Thank you for this message.

You have our permission to adapt the requested content for use in as a tool in your quantitative study investigating the effect of student self-assessment with goal setting.

Please credit the authors, full title and publisher, Pearson Education, Inc., New York, NY.

Sincerely,
Vineta
Vineta Lewis
Permissions Supervisor
Pearson Education
200 Old Tappan Road
Old Tappan, NJ 07675
Phone 201-236-3281
Fax 201-236-3290

APPENIDX F: Permission from ReThink Mathematics! Publisher

From: Torrey Volk <torrey@rethinkmathematics.com>
Sent: Wednesday, March 25, 2015 2:24 PM
To: Laura Clift
Subject: Re: How to Build a Stronger K-8 Mathematics Program

Sure. You can have permission to use our assessments.

Let me know if you would like to get together to discuss your work .....fascinating content !

Torrey~
Sent by mobile phone -

On Mar 25, 2015, at 10:15 AM, Laura Clift [redacted] wrote:

> Good morning, Ms. Volk:
>
> My name is Laura Clift and I am a doctoral student from Liberty University located in Lynchburg, Virginia. My doctoral dissertation is on the effects of self-assessment with goal setting on student academic achievement and motivation. I have attached a copy of my abstract for your review.
>
> I am writing to you because I have created a mathematics assessment based on some problems found in the ReThink! Mathematics program. Therefore, I would like to request your permission to use my assessment as part of the study. I have attached a copy of this for your review. As the author of ReThink! Mathematics program, you will be properly cited throughout my work.
>
> I am seeking written permission to use this tool. I look forward to your favorable reply. Please do not hesitate to contact me with any questions or concerns.
>
> Respectfully,
> Laura Clift
>
> Laura Dvornick Clift, Teacher
> [redacted]
> "Inspiring Excellence"
> <image001.png>

APPENIDX G: Permission to Use MSLQ (Modified)

From:	Janie Knieper <jknieper@umich.edu>
Sent:	Wednesday, February 04, 2015 12:12 PM
To:	Laura Clift
Subject:	Re: Request to use MSLQ - modified
Attachments:	EP4002pp117-128.pdf

Dear Laura,

You may hear yet from Teresa Duncan about your request. The MSLQ exists in the public domain. You do not need to ask permission to use it and you may modify it for your research. We only request that you cite it properly in your research publications. Here is a related document. Sincerely, Janie Knieper

Janie C. Knieper, Administrative Specialist
University of Michigan
Combined Program in Education and Psychology
1406 School of Education
610 East University Avenue
Ann Arbor, MI 48109-1259
e-mail: jknieper@umich.edu phone: (734) 763-0680 fax: (734) 615-2164

APPENDIX H: Lesson Planning Guide

Pacing Guide

Unit 4: Fraction and Decimals

Time Frame	Instructional Focus	Standard	Key Vocabulary	Instructional Tools
	Pre-Assessments			
Week 1	Parts of a Whole Parts of a Set	4.NF.1	fraction numerator denominator	fraction models number lines standard notation (a/b)
Week 2	Equivalent Fractions Adding denominators of 10 & 100	4.NF.1 4.NF.5	equivalent fraction	fraction models standard notation algebraic equations (4/8 = x/16)
Week 3	Comparing and Ordering Fractions Mixed Numerals	4.NF.2	improper fraction	fraction models number lines standard notation
Week 4	Fractions to decimals Tenths & Hundredths	4.NF.6	decimal decimal point hundredth tenth	fraction models number lines
Week 5	Compare and Order Decimals	4.NF.7		number lines standard notation
Week 6	Fraction and Decimal Equivalents	4.NF.6		fraction models number lines standard notation
	Post-Assessments			

APPENDIX I: Demographics File Variable Description

Variable	Label	Value	Measure
group	C or I	1 = Control 2 = Intervention	Nominal
stud_descriptor	Alpha-numeric	None	Nominal
gender	gender	1 = Male 2 = Female	Nominal
ethnicity	Race	1 = Caucasian 2 = African American 3 = Hispanic 4 = Pacific Islander 5 = Asian 6 = More than One Race	Nominal
support	Math support	1 = Yes 2 = No	Nominal
IOWA	Percentile Score	None	Scale

APPENDIX J: RawScores File Variable Description

Variable	Label	Value	Measure
group	C or I	1 = Control 2 = Intervention	Nominal
stud_descriptor	Alpha-numeric	None	Nominal
PM01… PM41	Item_num preMSLQ	None	Ordinal
M01… M41	Item_num postMSLQ	None	Ordinal
PFD01… PFD25	Item_num preFDUA	0 = Incorrect 1 = Correct	Nominal
FD01… FD25	Item_num postFDUA	0 = Incorrect 1 = Correct	Nominal