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Effects of Embedded Study-Skills Instruction on High School Students' Attitudes Toward Mathematics

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COLLEGE OF EDUCATION

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2014

Abstract

Effects of Embedded Study-Skills Instruction on High School Students' Attitudes

Toward Mathematics

by

Alberta Diahann Flowers Banks

MA, Kennesaw State University, 2001

BS, Mercer University, 1994

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

The target school used embedded study skills in Algebra I classes to improve attitudes toward mathematics. The purpose of this sequential, explanatory mixed-methods study was to examine the effect of embedded study-skills instruction on students' attitudes toward mathematics. Metacognitive theory was used for this study's framework. Participants were 28 Grade 9 and 10 students who repeated Algebra I. Quantitative data from the Attitudes Toward Mathematics Inventory assessed students' pre- and post-instruction attitudes toward mathematics in 4 domains. Data were analyzed using 4 independent samples *t* tests for students who did and did not receive embedded instruction. Qualitative data were collected through a semi structured group interview to explore 6 students' perceptions on how the intervention affected their attitudes toward mathematics. Open and axial coding strategies were used to develop themes. Quantitative results indicated no significant differences in students' attitudes toward mathematics, while qualitative findings supported the use of the intervention to develop students' positive attitudes in mathematics. A recommendation was that educators undergo professional learning opportunities to increase awareness of the impact of embedded study skills on student learning and how to use this instruction in lessons. Positive social change may occur if educators are provided with insight in embedded study skills that could improve students' attitudes toward mathematics, which ultimately may encourage students to study higher level mathematics and to pursue mathematics-based careers.

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Dedication

I dedicate this study to my husband, Harry, and my daughters, Ashley and Skye. You have traveled this journey with me and provided support and love to keep me on the right path. Through many busy weekends and late nights, you have sacrificed your time and allowed me to dedicate the time needed to complete this study. Thank you for your prayers and abundant love. I appreciate you. Thank you for being my rock.

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Section 1: Introduction

There is a sense of urgency for the United States to maintain technological and economic leadership in a global society (Roberts & Flores, 2009). The United States faces a future of accelerating retirements in technological fields and a decline in students pursuing technological degrees (National Mathematics Advisory Panel, 2008). There appears to be a decline in the number of students in America who are pursuing higher level math courses that prepare them for majors and careers in science, technology, and mathematics currently referred to as STEM careers (Hill, Corbett, & St. Rose, 2010; Zelkowski, 2010). Therefore, if Americans are to compete successfully in a global society, it is essential for educators to work toward increasing not only the mathematics skills of all students, but their interest in and desire to pursue the subject as well.

Moreover, societal demands are requiring all students to have more in-depth mathematical knowledge. According to Wilkins and Ma (2003), society's current technological and scientific advances require all high school graduates, not only those who go on to pursue technological fields, to possess higher level skills in mathematics. They asserted, "in the present quantitatively complex society, a person needs a functional knowledge of mathematical content to make informed decisions as a citizen and as a worker" (p. 52). Consequently, high schools are feeling pressure to reexamine mathematics curricula and standards to ensure that high school graduates are college and/or career ready (Kress, 2005; No Child Left Behind Act, 2002; Phillips & Skelly, 2007; Watt, Powell, Mendiola, & Cossio, 2006). National advocates for improved mathematics education also share in the belief that a more in-depth knowledge of mathematics is needed to meet the demands of an ever-changing society (National Council of Teachers of Mathematics [NCTM], 2002; National Mathematics Advisory Panel, 2008).

One of the largest organizations for mathematics educators, the National Council of Teachers of Mathematics (NCTM; 2002), emphasizes the need for all students to have a greater understanding of mathematics. Therefore, mathematics educators are being challenged to research and employ strategies to ensure success in mathematics for all students (Georgia Department of Education, 2009; NCLB, 2002). NCTM has contended that mathematics educators can address the challenge by giving students access to the most rigorous mathematics curricula. For most students in the United States, this rigorous mathematical curriculum begins with an introduction to algebraic concepts as early as the beginning of their middle school careers (Haas, 2005).Consequently, 21st century mathematics education focuses on students' early access to and success in algebra.

Teaching algebra to all students as early as middle school requires a basic assumption that all students are capable of mastering algebraic concepts as adolescents (Haas, 2005).While some researchers believe that students can master algebraic concepts as early as middle school (Haas, 2005; Taylor-Cox, 2003), the National Mathematics Advisory Panel (2009) has contended that students' mathematical achievement declines late in middle school, which is about the time they are being introduced to algebraic concepts. Therefore, the concept of teaching algebra to all students has presented some instructional challenges for mathematics educators at both the middle and high school levels (Haas, 2005; Midgett & Eddins, 2001). More specifically, teachers are faced with the challenge of researching and employing strategies to increase student interest and performance in mathematics. School systems across the country have attempted to address the need to teach algebra to all students with varying results.

For instance, a study of an initiative adopted by the Chicago Public School system indicated that some students may not be able to master algebra without appropriate assistance (Allensworth, Nomi, Montgomery, & Lee, 2009). In an effort to increase access to more rigorous mathematical coursework in high school, ensure that all students have a choice of college, and increase the system's graduation rate, the Chicago Public School System offered Algebra I with no remedial instruction to incoming high school students. Results of the study indicated an increase in student course failure rates for the group of ninth grade students being studied (Allensworth et al., 2009). The researchers concluded that without specific supports in place, all students may not be able to succeed in a traditional algebra course.

Students in the United States are most often scheduled for their first algebra course, Algebra I, when they enter high school; if they are successful in this course, students are thought to be prepared for higher levels of mathematics (Schreiber & Chambers, 2003). Algebra I has long been considered the foundational course for more rigorous mathematical coursework (Haas, 2005; Walker & Senger, 2007). Typically, students who succeed in algebra pursue higher levels of mathematics in high school, whereas those who do not succeed in algebra and complete less rigorous mathematical coursework usually face challenges when seeking acceptance into institutions of higher learning (Portal & Sampson, 2001; Zelkowski, 2010). However, the successful acquisition of algebraic skills by the time a student completes ninth grade can be challenging for students and schools. This challenge may be due, in part, to the inconsistency in mathematics curricula being offered in various states (National Mathematics Advisory Panel, 2009). As the United States has not formally adopted a common core curriculum, states are given the flexibility to adopt a curriculum directed at meeting the needs of state schools.

Because of the flexibility given to states to adopt their own curricula, states are examining all variables contributing to more positive achievement outcomes for students in mathematics (Chouinard & Roy, 2008; Zelkowski, 2010). An area of research that has gained the attention of states as well as mathematics education researchers is the role that affective variables play in mathematics achievement (Chouinard & Roy, 2008; Grootenboer & Hemmings, 2007). Students' feelings about the value of learning mathematics and its benefits for their future are related to their performance in mathematics (National Advisory Panel, 2009; Schreiber & Chambers, 2003; Tavani & Losh, 2003). Other influencing affective factors related to performance in mathematics include students' attitudes toward the discipline (i.e., whether they like it and place value in it) and expectations in the school (Schreiber & Chambers, 2003; Tavani & Losh, 2003). In addition, self-confidence is an influencing factor related to student performance in mathematics. For example, if students do not feel that they can learn the concepts, then they most likely will not put forth the effort needed to be successful (Bandura, 1986). Therefore, it is necessary to also examine variables that influence students' attitudes toward mathematics.

One variable that may influence students' attitudes toward mathematics is how confident they feel in studying the subject; hence, the area of study skills instruction becomes important to consider when evaluating affective factors that influence students' mathematical performance (Hannula, 2002; Zimmerman, 1998). Perhaps students' development and use of study skills strategies contribute to students' confidence in studying mathematics because the students are afforded an opportunity to gain insight into how they learn mathematics. The purpose of this study was to test the hypothesis that students who are taught ways to study mathematics from a metacognitive perspective (i.e., embedded study skills) will have improved attitudes toward mathematics. When study skills are presented from a metacognitive perspective, students develop self-regulatory skills along with procedural skills (Boekaerts, 1999; Cornford, 2002; Stewart & Landine, 1995). The development of these self-regulatory skills may contribute to students' confidence and intrinsic motivation, which are key variables in academic success (Biggs, 1988; Kiewra, 2002; Zimmerman, 1998). With a closer examination of study skills instruction, it may be possible to impact the development of students' self-regulatory skills, positively influencing their success in mathematics.

Statement of the Problem

The United States is faced with the challenge of educating its youth to be successful in a highly technological global society in order to facilitate its growth economically (Change the Equation, 2010). To meet this challenge, students must be mathematically literate. The problem is that the United States has not experienced success in preparing students to meet the mathematical challenges of a future of accelerating retirements in the technological fields and a decline in students pursuing technological degrees. According to research conducted by Hanusek, Peterson, and Woessman (2010), American students graduating from high school in 2009 were less accomplished in mathematics than many of their global counterparts. Furthermore, the National Center for Educational Statistics (2009) noted findings from a study conducted by the Program for International Student Assessment (PISA) showing that American students' (15-year-olds) mathematics scores were below those of their counterparts in 23 of the 29 participating countries. In addition, the National Mathematics Advisory Panel (2008) reported a significant decrease in performance among American mathematics students during their eighth and ninth grade years. According to Hanusek et al. (2010), the United States' educational system must focus on developing a cadre of qualified scientists and engineers in order to maintain its competitive edge internationally. To facilitate the development of highly qualified scientists and engineers, there must continue to be close examination of secondary students' mathematical performance as well as research on the factors that impact performance.

As evidenced by the adoption of a new mathematics curriculum, the state of Georgia recognized the need to put systems in place to address students' low performance in mathematics. However, the state's end-of-course tests revealed the new integrated approach to the study of mathematics has resulted in higher failure rates in algebra for students since its inception (Georgia Department of Education, 2010). The targeted high school students have not performed as well as expected in the first year algebra course, as evidenced by low passing rates on the End of Course Tests (EOCT) in the past 5 years (Georgia Department of Education, 2010).

In 2006, the principal and mathematics department head attempted to address the problem of algebra achievement by offering students an opportunity to enroll in a math study skills course in conjunction with the algebra course offered. The idea to offer a math study skills course was abandoned within 2 years of its inception because of scheduling constraints and continued low student performance. Mathematics teachers and school administrators discussed the success and failure of the students in the math study skills course. Algebra teachers revealed that students demonstrated negative attitudes when placed in the support course because the students felt that the class was a remedial course and served no purpose for them. More prominent among the students was the feeling that they would be ridiculed by their peers. It appeared that some students began to disengage after being placed in the study skills course. Due to the decline in math performance and smaller than anticipated impact on student performance, an examination of alternative study-skills instructional methods was warranted.

The aforementioned high school resembles many high schools across the nation with declining student achievement in mathematics (Halat, 2007; Hanusek, Peterson, & Woessmann, 2010; Zelkowski, 2010). In the past decade, the National Council of Teachers of Mathematics (NCTM) sought to address underachievement in mathematics by creating standards that included algebra infusion from kindergarten through 12th grade (NCTM, 2000). Although many states chose to use this publication as a guide for implementing standards-based instruction, the Program for International Student

Assessment (2006) continued to report disparities in the achievement of American secondary mathematics students as compared to their counterparts in other nations. There are many possible factors contributing to the poor mathematical performance of American students, among which are (a) students' attitudes toward mathematics (Chouinard & Roy, 2008; Fredricks & Eccles, 2002; Ma, 1997), (b) teacher perceptions of how students learn mathematics (Kiewra, 2002), and (c) lack of preparation for advanced levels of study through acquiring study skills (Boyle & Weishaar, 2001; Fulk, 2003; Gettinger & Siebert, 2002). This study examined the effect of embedded study skills in algebra instruction (independent variable) on students' attitudes toward mathematics (the dependent variable).

Nature of the Study

In an effort to discover possible contributing factors to students' attitudes toward mathematics, this study examined the effect of embedded study-skills instruction on ninth and 10th grade students' attitudes toward mathematics. A sequential, explanatory mixed methods research design was used to address the purpose of the study. The Attitudes Toward Mathematics Inventory (ATMI) was used to assess students' attitudes toward mathematics in four domains: (a) self-confidence, (b) value, (c) enjoyment, and (d) motivation (Marsh, 2004; Tapia, 1996; Tapia & Marsh, 2002). Interviews with students permitted the investigation of their perceptions of study-skills instruction and the effect of study-skills instruction on their attitudes toward mathematics.

Research Questions

The study investigated the effect of embedded study-skills instruction on students' attitudes toward mathematics. Therefore, the study obtained information addressing the following quantitative research questions:

1. Is there a difference in self-confidence levels between students receiving embedded study-skills instruction in Algebra I and students who do not receive embedded study-skills instruction?
2. Is there a difference in the value of mathematics between students receiving embedded study-skills instruction in Algebra I and students who do not receive embedded study-skills instruction?
3. Is there a difference in the level of enjoyment for mathematics between students receiving embedded study-skills instruction and students who do not receive embedded study-skills instruction?
4. Is there a difference in the motivation to learn mathematics between students receiving embedded study-skills instruction and students who do not receive embedded study-skills instruction?

The study's fifth research question was qualitative: How does embedded study-skills instruction influence students' attitude toward mathematics?

Hypotheses

To determine if embedded study-skills instruction has an effect on students' attitudes toward mathematics, the following hypotheses were tested:

H_{01}: There is no statistically significant difference in self-confidence level between students receiving embedded study-skills instruction in Algebra I and students who do not receive embedded study-skills instruction.

H_{A1}: There is a significant difference in self-confidence level between students receiving embedded study-skills instruction in Algebra I and students who do not receive embedded study-skills instruction.

H_{02}: There is no statistically significant difference in the value of mathematics between students receiving embedded study-skills instruction in Algebra I and students who do not receive embedded study-skills instruction.

H_{A2}: There is a significant difference in the value of mathematics between students receiving embedded study-skills instruction in Algebra I and students who do not receive embedded study-skills instruction.

H_{03}: There is no statistically significant difference in the level of enjoyment of mathematics between students receiving embedded study-skills instruction in Algebra I and students who do not receive embedded study-skills instruction.

H_{A3}: There is a significant difference in the level of enjoyment of mathematics between students receiving embedded study-skills instruction in Algebra I and students who do not receive embedded study-skills instruction.

H_{04}: There is no statistically significant difference in motivation to learn mathematics between students receiving embedded study-skills instruction in Algebra I and students who do not receive embedded study-skills instruction.

H_{A4}: There is a significant difference in motivation to learn mathematics between students receiving embedded study-skills instruction in Algebra I and students who do not receive embedded study-skills instruction.

Purpose of the Study

The intent of this study was to examine the effect of embedded study-skills instruction on students' attitudes toward mathematics. Research has uncovered a variety of factors influencing students' attitudes toward mathematics (Chouinard & Roy, 2008; Fulk, 2003; Gettinger & Seibert, 2002; Ma, 2001). Ma (1997) asserted that there has long been an assumption that a student's attitude towards mathematics directly affects his or her achievement in mathematics. After a review of Ma's literature examining the effects of students' attitudes towards mathematics on achievement, it was concluded that it was the students' feelings of enjoyment rather than their feelings about the difficulty of mathematics that directly affected their achievement in mathematics. There is a gap in the research regarding whether embedded study skills instruction can serve as a catalyst to boost student's enjoyment, confidence, and motivation levels and possibly decrease negative attitudes toward mathematics (Chouinard, 2008; Linver & Davis-Kean, 2005; Wilkins & Ma, 2003). The research was designed to determine whether embedded study-skills instruction contributes to students' enjoyment, self-confidence, values, and motivation for mathematics.

Theoretical Framework

This study focused on the concept of learning to learn from the metacognitive perspective of self-regulated learning as it relates to study skills. Specifically, the concept of metacognition provided the theoretical framework for the study. Metacognition evolved in the field of cognitive psychology and describes how an individual is actively involved in his or her thinking process (Pastorino & Doyle-Portillo, 2009). Flavell introduced the concept of metacognition in 1979; since that time, a plethora of research has been conducted that has assessed the impact of metacognition on the academic performance of students. In addition, empirical investigations have been conducted that have investigated the influence of metacognitive instruction on problem-solving skills in mathematics (Sperling, Howard, Miller, & Murphy, 2002; Sperling, Howard, Staley, & DuBois, 2004; Swanson, 1990; Veenman, Kok, & Blöte, 2005; Veenman, Wilhelm, & Beishuizen, 2004). The study examined the effect of metacognitive instruction (i.e., study-skills instruction) on students' attitudes toward mathematics.

The constructivist classroom appears to be conducive to metacognitive instruction. When attempting to identify whether or not significant learning is taking place, educators must be able to recognize learning when it is exhibited (Wirth & Perkins, 2008). Wirth and Perkins (2008) described learning as a constructive process whereby the learner uses information obtained through previous experiences to develop better understandings. If a classroom teacher adheres to the understanding that learning is a constructive process, then the teacher takes on the role of facilitator or guide as opposed to an authoritarian role (Richardson, 2003). Teachers provide students with opportunities to extend prior knowledge and reflect on new understandings through inquiry and collaboration. In the constructivist classroom, Richardson (2003) noted, students are encouraged to constantly question their understanding and reflect on the process whereby they learn and understand.

In the 1950s, Bloom (1956) identified taxonomies of learning and outlined three learning domains: cognitive, affective, and psychomotor. According to Wirth and Perkins (2008), the cognitive domain emerges as the most widely used of these taxonomies. The cognitive domain is divided into six levels of understanding ranging from basic knowledge recall to synthesis and evaluation. After close evaluation of the six levels, evidence of four distinct categories of knowledge emerged within the cognitive domain. Of the four principal kinds of knowledge identified, metacognitive knowledge, which is essentially knowledge about how one thinks and learns, is critical to a student learning to learn.

The concept of learning to learn is based on the assumption that teachers help students to develop study-skills strategies for self-regulated learning and that students are encouraged to use critical thinking skills (Bembenutty, 2008; Cornford, 2002; Waeytens, Lens, & Vanderberghe, 1997). To present opportunities for students to shape their own learning, teachers should consider incorporating study-skills strategies into the mathematics classroom. Students can learn to learn by being taught study skills in a separate course; however, Kiewra (2002) encouraged teachers to try to embed the strategies into regular content areas. Incorporating study-skills strategies may appear to be a daunting task for teachers, but Pressley and Woloshyn (1995) offered four simple ways teachers may be successful: (a) modeling the strategy, (b) explaining why the strategy works, (c) showing how the strategy may be used in other contexts, and (d) providing practice opportunities. The teacher's role in incorporating study-skills strategies is important, but because of the metacognitive nature of study-skills instruction, the student plays the most important role (Glenn, 2003; Kiewra, 2002; Nordell, 2009). Therefore, teaching students to use strategies that assist in the development of their metacognitive abilities is vital to them successfully shaping their own learning.

Not only does the development of metacognitive skills play a vital role in students' abilities to learn, but there are also other implications for students. Gettinger and Siebert (2002) suggested that students' metacognitive abilities have an impact on the degree to which they apply their study skills and enhance the cognitive skills that are required to study successfully. Gettinger and Siebert reported that metacognitive skills are important to academic success. Marzano's (2005) learning theory model also supports the metacognitive approach to learning and highlights the importance of possessing good metacognitive skills. Marzano introduced three systems that operate consistently within the learner: (a) the self-system, (b) the metacognitive system, and (c) the cognitive system. Within the metacognitive system, self-assessment emerges as a prominent aspect of a student's ability to learn to learn and effectively use study-skills strategies. For example, if a student experiences success on an assessment in math class after using a note taking strategy, he or she may be more apt to continue using the strategy because he or she attributes success to the use of the note taking strategy. The strategy use has proven to be beneficial to the student learner. Hence, the student must be able to determine how the strategies benefit him or her in order to continue to employ them.

Assumptions, Limitations, Scope, Delimitations

Assumptions

Two assumptions were made about the study. First, most students enter high school unprepared for the rigorous study demands of higher levels of mathematics (Georgia Department of Education, 2010; Hanusek et al., 2010; Kiewra, 2002; Marzano, 2005; National Center for Educational Statistics, 2009; National Mathematics Advisory Panel, 2008). Secondly, more time and effort are needed to obtain information that could be used to help students learn how they learn. This need is evidenced by an increased focus on metacognitive instruction and affective domains of learning to help students achieve at higher levels (Mathematics Advisory Panel, 2008).

Limitations

Limitations are defined as those factors that the researcher has identified as potential weaknesses of the study (Beins, 2005; Creswell, 2009). Essentially, limitations could pose a problem for the study's internal validity. A study would have low internal validity if a variable were inadvertently allowed to interfere with the independent variable. A variable that is said to interfere with the independent variable is referred to as a *confound* and often called an *extraneous* or *nuisance variable* (Beins, 2005). When a confound is present, it means that the researcher is unable to determine if the independent variable caused a change in the response of the participants (i.e., dependent variable), or if the change was due to some extraneous variable (e.g., history, maturation, testing situation, measure used, etc.).

One possible weakness identified early in the planning stage of this study was related to testing effects (Beins, 2005; Creswell, 2009). Pre- and posttest measures (i.e., repeated measures) could be a problem if the participants' responses reflect their familiarity with the instrument, for example, rather than any actual differences in their responses. Therefore, it was decided that comparisons would be made between the control group (i.e., the group of students not exposed to the independent variable) and the experimental group (i.e., the group of students who were exposed to the independent variable). Both groups of students were asked to complete the ATMI after the experimental group was exposed to embedded skills instruction. Furthermore, to decrease any limitations that would be present from individual differences of the participants, randomization was used to assign the classes to either the control (i.e., no embedded skills instruction) or experimental (i.e., embedded skills instruction) groups. This meant that all students (e.g., low, average, and high achievement levels) enrolled in the algebra courses had an equal chance of being in the control or experimental condition (Beins, 2005).

As explained by Babbie (2005), there are times when these threats can be resolved (i.e., mitigated), and then there are times when the researcher must proceed with the threat present. As this study tested for significant differences between the students' attitudes toward mathematics after exposure to embedded skills instruction, it was imperative that a valid and reliable instrument was used. The instrument selected has evidenced acceptable levels of validity, reliability, and generalizability (March, 2004; Tapia, 1996; Tapia & March, 2002). In addition, this study used a qualitative measure to obtain more in-depth information about students' attitudes toward mathematics. For example, group interview sessions were used to obtain information that would explain how embedded skills instruction influenced the students' attitudes toward mathematics. Finally, it was believed that the use of the mixed methods research design would help offset any problems emerging as a result of the use of only one data collection method (Creswell, 2009).

Another possible limitation existed because of the potential for a differential loss of participants (Beins, 2005). If students were present at the beginning of the study but were not there at the end, then the results from the study would have been affected. For instance, if students chose to withdraw from the study in a nonrandom manner, there could have been problems for the interpretation of the findings in the study. This could have been the case, for example, if the results showed statistically significant differences in the attitudes of students after exposure to embedded instruction, and at the same time, all of the students who had low grade point averages initially dropped out of the study. A pattern such as this would have led to rejection of the null hypothesis when it fact it could have been true. Consequently, an assessment of the characteristics of any participants who dropped out of the study was made to determine if they had similar characteristics to those who remained until the completion of the study.

Scope of the Study and Delimitations

Delimitations are used to narrow the scope of research (Beins, 2005; Creswell, 2009). In this instance, delimitations were used to establish the boundaries of the study, which influenced the ability of the results to be generalized to other groups of people. As explained by Beins (2005), delimitations establish the aspects of research known as the *who*, *what*, *where*, and *when* of a study. The scope of this study was one high school in Georgia. It was delimited to students who were enrolled in an on-level Algebra I course for the first time. Findings from this study can only be generalized to other ninth and 10th grade students who are in similar settings and who are primarily Caucasian and African American girls (60% of the sample was composed of female students) and who are on average 14 years of age. For example, findings may not be generalized to elementary or college students. Finally, delimitations are those limits set by the researcher over which he or she has control (Creswell, 2009). Participants in this study were students whose teachers agreed to participation in the investigation. The scope of the study was limited to these classrooms because of ethical concerns as well as the belief that teachers who were willing to participate would be more likely to adhere to the instruction requirements as designed and respond to the requests of the investigation as needed.

Definition of Terms

Key terms and definitions used in the context of this study are presented.

Advancement via individual determination (AVID). AVID is an elementary through postsecondary college readiness system designed to increase school-wide learning and performance (AVID College Readiness System, 2008).

Cognitive organizers. Cognitive organizers, which are sometimes referred to as *concept maps*, *advanced organizers*, or *graphic organizers*, are visual aids that help students understand the relationships between ideas or facts used in a learning task (Hall & Strangman, 2002).

Metacognition. Metacognition evolved in the field of cognitive psychology, which explains how an individual actively participates in the learning process (Flavell, 1979; Pastorino & Doyle-Portillo, 2009).

Metacognitive skills. Metacognitive skills refer to the knowledge an individual needs to be able to regulate his or her learning (Stel & Veenman, 2010).

Study skills. The definition of Thomas (1993) was used to define study skills as used in the context of this investigation. He described study skills as the “effective use of appropriate techniques for completing a learning task” (p. 7).

Study-skill strategy. A study-skill strategy (Gettinger & Siebert, 2002) is described as the approach used by an individual that includes how he or she thinks, acts, plans, and evaluates his or her behaviors when engaged in studying.

Significance of the Study

Findings from this study provide important information to educational leaders about the affective aspects of learning and contribute to the body of knowledge addressing positive social change for students and the communities in which they live. For instance, public education continues to face problems with student achievement in mathematics generating concern on a larger scale with the nation’s global competiveness (Hanushek, Peterson &Woessmann, 2010; Roberts & Flores, 2009). There has been improvement in students' mathematical performance in the past couple of decades, but students from the United States still exhibit less mathematical ability than students from other nations (Portal & Sampson, 2001; Program for International Student Assessment, 2006). This study was also designed to collect information that might prove beneficial to mathematics educators who are interested in factors that influence students' attitudes toward mathematics, which might influence students' achievement in mathematics.

The study's implications for the future standing of America in relation to other nations are clear. If students are not able to pursue careers in fields requiring higher levels of mathematics, the United States will be less likely to have a work force that can respond to challenges presented in modern society (Jacobs & Simpkins, 2005; Mottet et al., 2008). Likewise, success in mathematics affords students an opportunity to enroll in college and have career options that increase their prospects for future income, which positively impact their quality of life. Students' challenges with mathematical achievement appear to be more obvious in secondary schools, where they hinder them from pursuing higher levels of mathematics and steer them away from careers requiring higher levels of mathematics (National Mathematics Advisory Panel, 2009; Zelkowski, 2010).

Summary

Because educators are seeking ways to improve students' access to and interest in higher level mathematics, there is a need to investigate factors contributing to students' attitudes toward the subject. All students need the experience of higher level mathematics to be able to compete nationally and internationally (Kress, 2005; NCTM, 2000; National

Mathematics Advisory Panel, 2009). Additionally, mathematics educators are in need of strategies that cultivate success in algebra to promote higher levels of mathematics study in preparation for college and employment (Conley, 2010; Rakes, Valentine, McGatha, & Ronau, 2010; Zelkowski, 2010). This study investigated the use of embedded study-skills instruction as a tool for mathematics educators to promote the successful acquisition of algebraic skills and concepts among ninth and 10th grade students.

Section 1 was used to explain the problem and nature of the study. The research questions, hypotheses, purpose of the study, and theoretical framework were discussed. Furthermore, the assumptions, limitations, scope, and delimitations were presented, as well as the way key concepts were operationalized in this study and the significance of the study. In Section 2, information obtained from a comprehensive literature review (e.g., the importance of study-skills instruction, AVID, metacognition, learning to learn, and attitudes toward mathematics) is presented and discussed. Section 3 describes the specific methodology that was used to conduct the study. Section 4 summarizes the findings from the study. Finally, Section 5 presents the conclusions, implications, and recommendations made as a result of the findings obtained from the investigation.

Section 2: Literature Review

An extensive literature review was conducted in order to synthesize information from current research related to this study. Studies and articles that were published in journals, dissertations, national databases, and the publications of professional organizations were reviewed. Key terms were entered in combinations to search for relevant information, including *study skills instruction* and *the importance of study skills instruction*, *metacognition*, *attitudes toward mathematics*, *high school mathematics*, and *students' attitudes toward learning*. The search engines used included ACM Digital Library, EBSCOhost, ERIC, JSTOR, MathSciNet, Project Muse, Proquest Databases, PsycINFO, Psychology and Behavioral Sciences Collection, PubMed, Science Digest, and Wilson Omnifile.

The remainder of this section summarizes literature relevant to this study. It is composed of three subsections. The first section reviews the concept of learning to learn because this concept addresses the need for students to develop metacognitive skills associated with study skills to impact academic competence. The second section explores study skills and describes some core study skills that may prove to be beneficial in improving the attitudes of students about mathematics and their metacognitive skillfulness. The third section addresses students' attitudes toward mathematics and how those attitudes contribute to the self-regulatory skills needed to enhance metacognition and impact student success in mathematics. This study was developed as a result of the gap that exists in the current literature on the effects of study-skills instruction on students' attitudes toward mathematics, as well as my interest in the identification of effective instructional strategies for mathematics.

Learning to Learn

Study skills strategies may contribute to students' learning to learn because reading and thinking are required. This concept also reflects the assumption that teachers help students to develop study skills and that students are encouraged to use critical thinking skills (Kiwera, 2002; Waeytens, Lens, & Vandenberghe, 1997). The concept of learning to learn is deeply rooted in the metacognitive perspective, as are most study skills strategies. Some researchers feel that equipping students with study skills enables them to learn how to learn (Ellis, 2003; Kiewra, 2002; Waytens, Lens, & Vandenberghe, 1997). Moreover, Richardson, Robnolt, and Rhodes (2010) asserted that a complex strategy requires deeper processing and consequently leads students to learn how to learn more effectively. Therefore, students should be given opportunities to use complex strategies as often as possible in their classroom environments to strengthen their ability to learn how they learn. This notion requires giving attention to instruction that promotes the development and use of study-skills strategies (Richardson et al., 2010).

Study skills are thought to be most beneficial when instruction occurs within the content area classroom (Richardson et al., 2010). Some researchers have indicated that study-skills instruction may not be beneficial to students learning to learn because most study-skills instruction at the secondary level occurs in isolation with little opportunity for application of the acquired skills (Petersen, Lavelle, & Guarino, 2006). Although students could learn to learn when strategies are taught in the context of separate study-skills courses, some researchers are in agreement that teaching study skills in isolation does not yield the best results with the learner (Kiewra, 2002; Petersen et al., 2006). These researchers have reported that an ideal situation would involve the teacher embedding strategy and instruction that teaches students how to learn within the subject matter. Furthermore, Kiewra (2002) concluded that instructors should determine which strategies are the most effective and develop a procedure to incorporate the study skills strategies in content teaching. Determining which strategies are effective can prove to be challenging with all of the choices available. However, Kiewra stated there are four crucial components of learning: (a) note taking, (b) organizing, (c) relating, and (d) monitoring. These components contribute to students' metacognition, enabling them to develop the skills needed to think about how they process information (i.e., learn to learn).

Stewart and Landine (1995) asserted that the study of metacognition has significant implications for teaching study skills. As indicated earlier, metacognition involves students being able to examine their own thought processes when learning. The student learns how to learn. Research also suggests that metacognitive approaches provide benefits for the teachers as well as the learners (Petersen, Lavelle, & Guarino, 2006; Stel & Veenman, 2010; Stewart & Landine, 1995). According to these researchers, metacognitive approaches teach learners about learning and at the same time that they encourage teachers to tailor their presentation of learning experiences to desired learner outcomes. Therefore, metacognitive approaches have implications for the learner and the teacher, requiring a more active part by both in the learning process.

Metacognitive strategies for learning require that the learner be actively engaged in learning. Metacognitive strategies involve students determining the required skills for task completion, assessing the skills they are equipped with, and deciding on an appropriate approach for the desired outcome. The metacognitive approach to learning is a process that helps students to help themselves foster success academically. Stewart and Landine (1995) concluded,

> S*tudy skills* presented in a *metacognitive perspective* will produce lasting effects. Students will have increased self-confidence, will have *skills* to accomplish learning tasks, will be able to apply these *skills* in appropriate contexts, and generally are better able to achieve the academic goals they establish for themselves. When students are given the ability to monitor their thinking and to apply the appropriate strategy to the task, they will have the self-regulatory ability to make effective use of aptitudes and *skills* in whatever the learning task. (p. 20)

Because metacognitive skillfulness requires students to develop self-regulatory skills, it is vital to the learning-to-learn concept.

Stel and Veenman (2010) investigated the effects of metacognitive skillfulness in a longitudinal study. The study, involving students aged 12–14 years, investigated the quantity and quality of the development of their metacognitive skills. Some of the metacognitive skills highlighted paralleled the core study skills discussed in the next section. For example, organizing ideas, time management, and writing down all steps and processes in math problem solving (i.e., note taking) were the metacognitive skills associated with mathematics in the study. The study also sought to determine whether intelligence is related to metacognitive skillfulness development. Students were given two separate tasks to complete while thinking aloud: a math problem-solving activity and a history text-studying activity. The findings not only indicated that metacognitive skills contributed to learning performance, but also showed that there were quantitative and qualitative improvements independent of students' intellectual ability. Essentially, all students should benefit from metacognitive skillfulness through effective use of study skills across multiple disciplines.

Study Skills Instruction and Importance

For the purposes of this study, *study-skills instruction* refers to a curriculum taught by the teacher designed to enhance student acquisition of knowledge and to promote academic success (Harris & Pressley, 2009). Richardson, Robnolt, and Rhodes (2010) pointed out that since the early 1900s, there has been research that has addressed the need for study-skills instruction and has identified the most useful study skills to the learner. Study skills that have remained consistent in study-skills instruction over the years include finding information, note taking, and listening and reading attentively with the purpose of learning (Richardson et al., 2010). One recurring theme in study skills instruction throughout the years has been their importance to the academic competence of students.

The use of operative study skills is linked to academic proficiency (Gettinger & Siebert, 2002; Richardson et al., 2010). Moreover, Gettinger and Siebert (2002) reported that high-achieving students employ a variety of study tactics in a purposeful manner and that low-achieving students use a restricted range of study skills. For example, high-achieving students typically view note taking as an important aspect of academic success because they use notes as a resource to prepare for assessments. These high-achieving students appear to understand the link between their note taking and achievement. On the contrary, low-achieving students tend not to have the ability to explain or understand why good study habits are important for learning (Gettinger & Siebert, 2002). Therefore, not only is it important for students to have a variety of study skills in their repertoires; they must also apply the skills purposefully.

Often, the expectation of educators is that a student reaching the secondary level of education possesses a variety of study skills; however, that expectation is currently challenged. Although many secondary educators expect students to enter high school equipped with study skills for success, it appears many of them do not (Lambert & Nowacek, 2006). Research indicates that high school students have difficulty with study skills related to the ability to listen and follow directions, take notes, and stay organized (Lambert & Nowacek, 2006; Polloway, Patton, & Serna, 2001). This lack of adequate study skills becomes more evident when students enroll in secondary mathematics courses requiring higher order thinking, such as algebra (Steele, 2010). To address the needs of mathematics students at this level, Rakes, McGatha, Ronau, and Valentine (2010) suggested that more high school teachers should incorporate study skills in their instruction. More specifically, Rakes et al. concluded that instruction that includes development of conceptual understanding (e.g., study skills) will improve student achievement far more than instruction focusing on the procedural knowledge of mathematics. Because the need for improved study-skills instruction is being realized by secondary educators, there is an increase in literature that investigates how studying contributes to academic excellence.

Learning to study well is an asset to students, whose objective in education is the acquisition of knowledge and academic promotion (Gettinger & Siebert, 2002). Kiewra (2002) examined studying as a distinct skill from other forms of schoolwork in three ways. According to Kiewra, (a) studying requires training and practice of techniques to help a learner gather and use information, (b) studying requires a deliberate and conscious effort because it is not passive, and (c) studying is a personal and individualized activity. Ellis (2003) provided support for Kiewra's work when he concluded that classroom learning occurred within a social context, whereas, studying was normally an individual activity. Taking the initiative to study or determining the need to study requires self-regulation (Gettinger & Siebert, 2002; Nordell, 2009). These self-regulatory skills require focus and high levels of engagement from the learner.

Study skills may contribute to increased levels of engagement for the learner. Gettinger and Siebert (2002) conducted research and concluded that one of the benefits of developing effective study skills is that their use may contribute to higher levels of engagement because of the amount of time spent on reviewing and thinking about the material. Therefore, the effects of a study-skills strategy may not be a direct result of the student learning the study-skill strategy, but rather the fact that the strategy requires the student to spend more time processing the information being studied (Gettinger & Siebert, 2002). As stated by Gettinger and Siebert, "although direction of the influence between engagement and study skills remains unclear, it is evident that study skills and engagement are highly interrelated, and academic competence is integrally linked to both enablers" (p. 354). While study skills may contribute to the levels of engagement of the learner, the level of engagement can only be strengthened by a learner feeling that studying is valuable to his or her academic success.

Not only is the student perspective on the value of study skills important; so is that of the teacher. That is to say, the teacher's perspective has an impact on how students view the importance of study skills (Rakes, Valentine, McGatha, & Ronau, 2010). At one high school in the Midwest, a three-phase study was used to explore the insights of teachers and ninth grade students regarding academic performance (Fulk, 2003). A total of 75 teachers and 265 students were surveyed to assess the greatest concerns of the teachers and students regarding school success. Specifically, the survey for the teachers inquired about their perceptions of their ninth grade students' study skills. Students were prompted to identify their strengths and weaknesses in regard to their study skills. The survey also asked students to examine their skills for fulfilling the academic requirements of their classes and to clarify whether or not they perceived a difference in male and female academic skills.

The results from Fulk's (2003) study indicated similarities between teacher and student perceptions about study skills as well as some differences. The survey results indicated that teachers were primarily concerned with three areas. One concern was the students' ineffective test preparation and test-taking skills. Conversely, students indicated that poor study habits, particularly in homework completion and test preparation, were an area of concern for them. Teachers were also concerned with students' poor organization and time management. On the contrary, students exhibited the highest scores on the organization subscale. A third area of concern for teachers was the students' lack of concern about grades. Students who are entering ninth grade from middle school are just beginning to understand how earning credits in a class equates to a passing grade, which ultimately leads to graduation. Although teachers and students have some common perceptions about the ninth grade students' study habits, this research also supports the notion that students may not realize the importance of study skills upon entering high school.

Fulk (2003) also had teachers evaluate the academic strength of ninth grade students. The teachers' evaluations revealed that the majority of ninth grade students (a) demonstrated enthusiasm for learning and (b) had a desire to earn good grades for their work, which included group work and active participation. Teachers also reported that the desire did not always translate into students recognizing the importance of study skills. Results from this study were used in the implementation of solutions for the targeted sample. Information was also obtained about study habits, self-regulation, and test anxiety, which indicated a need to explore study-skills strategy instruction and determine which core study skills would be most beneficial to the students.

One program that has experienced success with using study-skills instruction to impact student performance is the Advancement Via Individual Determination (AVID) program. The AVID program began as a classroom initiative to prepare underachieving students for a college education (Conley, 2010; Watt, Powell, Mendiola, & Cossio, 2006). The AVID program uses a class where students are taught basic study-skills strategies including note taking (Cornell note taking method), test taking, and time management during their school day. Students are also taught organizational skills to enhance learning and studying and are evaluated on the use of the strategies. Extensive research has assessed the success of the AVID program with different grade levels (Watt, Mills, & Huerta, 2010; Watt et al., 2006). Watt, Mills, and Huerta used course data to show that AVID eighth graders who took algebra passed at a higher rate than their peers who did not have the support of the AVID curriculum. Among national eighth grade AVID algebra takers across the United States, 51.4% were successful, whereas only 22% of eighth grade non-AVID algebra takers in the nation were successful. This statistic alone warrants a closer look at the methodologies and study-skills instruction AVID uses to prepare these students for algebra.

Core Study Skills

There are some core study skills that have been investigated since the early 1900s that remain a focus of educational research (Ellis, 2003; Richardson et al., 2010). These study skills contribute to the learner's cognitive development and include effective note taking, organizing ideas (i.e., graphic representations), time management, and location and reference (Richardson, Robnolt, & Rhodes, 2010). Although some of these study skills may be used in conjunction with each other (i.e., note taking and graphic representation), they also may be used independently to impact academic success because they add to the expansion of students' metacognitive abilities (Richardson et al., 2010). The skills of note taking, cognitive organizers, and time management are discussed in more detail in Section 3.

Note-Taking Strategies

Note taking is one of the core study skills that enhances metacognitive skills and is valuable across all disciplines. According to Ellis (2003), taking notes consist of observing an event, recording observations, and reviewing what has been reported, with each part of this process being dependent upon the other. Ellis emphasizes the note taking itself should be the least important part of the process because the process requires organization of one's thoughts, paraphrasing, summarizing, and capturing main ideas that enhances students' metacognition. There are many formats for note taking currently being utilized but for the purposes of this study, the Cornell note taking method was examined.

Walter Pauk, a professor of education at Cornell University, developed the Cornell note-taking method. It is a widely used system for taking organized notes on lectures, readings, etc. One illustration of the Cornell system provided by Pauk (2010) was the student should vertically draw a line on the left-hand side of the paper. The area to the right of the line contains the notes. Key words and sample questions are written to the left of the vertical line. As the notes are reviewed, the area left of the line should be completed (see Figure 1). The left-hand column may also be used to quiz one's self on the information that follows on the right-hand side by just folding the paper where the right side is not visible. While the Cornell note taking method is widely used by colleges and universities, there are other methods also being researched.

	Solving Multi-step Equations
Solving equations	Step 1: simplify Step 2: "undo" all addition or Subtraction Step 3: "undo" all multiplication Division
What are the steps to solve multi-step Equations?	Step 4: write value of the variable Step 5: Check solution Example: 2(x+3) – 7 = 9 2x + 6 – 7 = 9 2x + (-1) = 9 - (-1) - (-1) ----------------------
Example	2x = 10 2 2 ---------------------- X = 5 Check: 2(5+3) - 7 = 9 2(8) - 7 = 9 16 – 7 = 9 9 = 9

Figure 1. Example of Cornell notes.

A study conducted with secondary students in Kansas compared use of Cornell note taking to the guided note taking to determine if one method was better than the other with respect to impact on academic achievement (Jacobs, 2008). Two classes of English students with similar mean grade scores were first given a survey regarding their attitudes and perceptions about note taking. After completing the survey, students were given text to read and directed to take notes in preparation for a quiz on the text. After this practice exercise, the two classes were given instruction on the two note taking methods. One class received instruction on Cornell note taking and the other on guided note taking. The students were then asked to practice using these methods for a quiz on another reading passage. Finally, the two classes were instructed to read the same passage and use the method they were taught to take notes. After this quiz, the students completed the survey regarding their attitudes and perceptions about note taking again. The study found both classes performed better on the quiz after receiving note taking instruction. Results also indicated although the Cornell note group experienced a smaller increase in correct answers than the guided note group, the Cornell group was better able to answer higher level questions. Therefore, this study contributes to the literature that suggests note taking contributes to academic success and Cornell note taking may be beneficial to increase metacognitive skillfulness. Cognitive organizers which may be used in conjunction with note taking may also contribute to the learners' metacognitive abilities.

Cognitive Organizers

Cognitive organizers such as graphic organizers, mind maps, or concept maps, are visual patterns that can assist a student with recall (Tzeng, 2010). Cognitive organizers, which help with information input and relationships, can help students retrieve prior knowledge and to make connection with key concepts (Tzeng, 2010). The maps work for both verbal and nonverbal recall. It is also possible to use mind maps in conjunction with Cornell notes. Ellis (2003) endorsed the idea that the creation of mind maps was beneficial to students. As a student builds a mind map on paper, s/he is also constructing the map in his/her mind. These techniques are particularly useful for math education, because it organizes symbols visually (Ellis, 2003). For example, the use of concept maps allows a student to make a visual representation of relationships between ideas and concepts. Figure 2 illustrates a representation of a concept map showing the relationship of terms associated with the concept of integer operations. This concept map could serve to enhance the students' ability to link the rules of integer operations with the signs of the integers and assist with recall of the information.

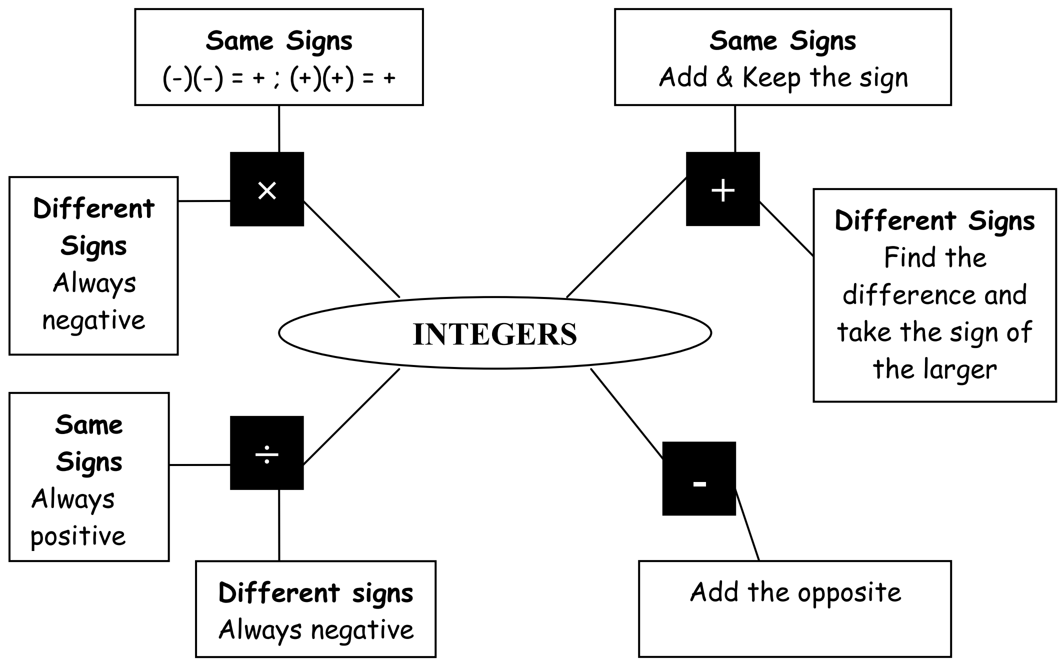

Figure 2. A cognitive map showing terms associated with integer operations.

These cognitive organizers are beneficial to students' cognition because they require the use of metacognitive skills like organizing thoughts about the process.

Time Management

Lack of effective time management skills typically correlate with lower grade point averages for the student. Using the Learning and Study Skills Inventory (LASSI), Bender and Garner (2010) examined the relationship between several factors including: gender, time management as a study habit, motivation and achievement. The Learning and Study Skills Inventory is a diagnostic tool that measures students' self-regulated learning skills and motivation (Bender & Garner, 2010). The results of the study indicated overall, students who exhibited low scores on Time Management or Attitude earned grade point averages that were significantly poorer than their peers' grade point averages. These results provided necessary insight into the need for academic interventions with regards to time management for students.

Ellis (2003) referred to time as our most valuable resource and provided some ways to assist students with time management. He argued that students should start by observing how their time is utilized both in and out of the classroom order to assess if it is being used productively. Ellis (2003) offered recommendations to monitor how time is spent over a two-week period. Monitoring provides information regarding how time is spent and in what amounts. This information can then be used to prioritize activities. It also allows the student to become more effective in scheduling time. In order to make decisions about how much time is required for optimal study, time itself must be effectively managed.

Time management is an important aspect of study skills. If time is managed efficiently, students can perform better academically (Glenn, 2003). The challenge for teachers is determining how to instruct students effectively on proper time management. With no prescribed curriculum for time management, teachers and counselors usually have to develop their own course of study. Glenn also noted some key time management factors teachers should share with students. Students should: (1) estimate the length of time it will take to complete an activity, (2) focus on the activity, (3) reduce distractions, (4) divide large tasks into smaller components, (5) start tasks early, (6) write assignments down, (7) complete the more difficult parts of an assignment first, and (8) use down time efficiently. Although downtime may be thought of as an inactive time or time during which production is stopped, it may be a time when studying can occur. One example is utilization of time spent waiting for a ride after school or time spent waiting for practice in sports to begin. Students should be encouraged to use downtime to complete smaller tasks. Basically, in all situations, students should be aware of their time and utilize it effectively.

As with all cognitive strategies instruction, study skills instruction requires students be encouraged and monitored on the use of the skills. Researchers agree although monitoring use of study skills strategies may encourage students to use them more, it is ultimately the students' perceived value of the strategy that will foster continued use (Pressley & Harris, 2009; Richardson et al., 2010). If students feel the study skills strategies contribute to their overall academic success, then they are more inclined to utilize the strategies with or without supervision. Once the student develops the habit to utilize the strategies for success, the strategies are incorporated into students' learning process (Pressley & Harris, 2009). Therefore, a closer look into student attitudes may provide some direction for more effective study skill instruction.

Students' Attitudes Toward Mathematics

Attempts have been made by mathematics educational researchers to define a students' attitude towards mathematics (Martino & Zan, 2010). Recently, Martino and Zan (2010) conducted a study that generated support for a multidimensional model which describes students' attitudes about mathematics. This model has implications for teachers and students. The three dimensions of the model are the students' emotional dispositions about mathematics and the view of and confidence in math. The researchers also investigated students' negative attitudes. Martino and Zan reported the middle school level students' results indicated students developed more of an instrumental view of mathematics in conjunction with negative emotions about mathematics and perceived low competence. Utilizing the multidimensional model to clarify the construct of attitude has afforded these researchers the ability to identify the grade level where students start to develop negative attitudes towards mathematics and what emotions are associated with the negative attitudes (Martino & Zan, 2010).

Over the past decade, external and internal factors effecting students' attitudes toward mathematics have been examined in the literature (Fredricks & Eccles, 2002; Ma & Cartwright, 2003; Martino & Zan, 2010; Nordell, 2009; Watt, 2004). Hannula (2002) focused on a framework for analyzing and changing attitudes towards mathematics through the use of a case study. A framework of emotions, associations, expectation, and values were utilized to describe attitudes and changes in attitudes. This framework also was useful in concluding that attitudes can change greatly in a short span of time. However, one of the most significant findings revealed a student with a positive self-concept could develop a negative attitude as a defense strategy. That is, mathematics may cause negative feelings for a student with an otherwise positive self-concept. As a result, the student may continue to avoid mathematics and intensify feelings against it. It should be noted in the case study documented here, the student was able to develop a more positive attitude toward mathematics through a change in expectations. This finding leads to the question of what external factors may contribute to a students' attitude towards mathematics. However, there is no literature that examines the effect of study skills instruction as an external factor on students' attitude towards mathematics. Further research in this area is needed.

Value and Enjoyment

Another facet of students' attitudes towards mathematics is the view of the importance or value of mathematics. A small scale study conducted in Pakistan involving 82 secondary students concluded most of the students considered mathematics an important subject because it has relevance in their everyday life (Amirali, 2010). The quantitative study utilized a survey design to explore students' conceptions of the value and usefulness of mathematics in addition to their attitudes towards learning mathematics. Usefulness of mathematics had the highest mean score indicating most of the students found mathematics to be a valuable and useful subject. More specifically, most students agreed mathematics was useful in daily life. Findings also indicated more than 70% of the students surveyed enjoyed learning mathematics and showed positive attitudes towards mathematics and low levels of anxiety. However, Amirali (2010) noted these findings are in contrast to most findings which indicate most students at the secondary level dislike mathematics and have anxiety about the subject matter. One possible reason cited by Amirali for this contrast may be due, in part, to the students' positive experiences in and beyond school.

The teacher has a major impact on a student's school experience and according to Wilkins and Ma (2003) may influence a student's attitude towards mathematics. These researchers examined variables influencing students' attitudes towards and beliefs about the value of mathematics. Their findings indicated teachers' expectations were critical to the development of students' attitudes towards mathematics. Students had more positive attitudes about mathematics and its usefulness when they believed their instructors had expectations they would achieve. It was also determined that parents' and peers' beliefs about mathematics influenced the development of the students' attitudes towards mathematics.

Confidence and Motivation

Researchers agree a key component for academic success is a positive attitude toward the subject matter and the motivation to study (Ellis, 2003; Nordell, 2009; Robinson, 2003). According to the Organization for Economic Co-operation and Development (OECD), successful learners are also more likely to be confident in their abilities and believe learning is an investment than unsuccessful learners. This confidence helps with any future difficulties incurred in learning the subject matter (OECD, 2004). The Programme for International Student Achievement (PISA, 2006), compared students' confidence in overcoming difficulties in mathematics through the use of a self-efficacy index. Bandura (1997) describes self-efficacy as person's belief that s/he can accomplish a task. The students in the United States expressed higher degrees of self-efficacy as compared to their counterparts in Greece, Japan, Korea, Mexico, Brazil, Indonesia, Thailand, and Tunisia (PISA, 2006). Results of PISA's (2006) mathematics assessment indicated a correlation with self-efficacy and achievement in mathematics. In fact, the findings indicated a very strong predictor of student achievement was self-efficacy.

Motivation is also significant to learning (Artelt, 2005; OECD, 2004). In some instances, motivation is an extremely important impetus in learning (OECD, 2004). Researchers generally divide motivation into two categories: intrinsic motivation and extrinsic motivation (Baron et al., 2009; Ryan & Deci, 2000; Shaffer, 2009). Intrinsic motivation is characterized by internally generated motives; whereas, extrinsic motivation is characterized by external rewards for good performance (Artelt, 2005; Eccles, 1994; OECD, 2004; Shaffer, 2009). In the most recent study of the PISA (2009), an examination of motivational factors influencing students' attitudes towards mathematics revealed intrinsic motivation contributed significantly to students' interest in developing skills for success in mathematics.

Research has indicated the attitude about mathematics is related to student achievement in mathematics (Ma, 2000; Martino & Zan, 2010; Nordell, 2009). This study outlines research designed to determine the effects of embedded study skills instruction on ninth grade students' attitudes toward mathematics, particularly how the constructs of value, enjoyment, confidence, and motivation are affected. If a positive impact exists, then it may be that embedded study skills instruction in one mathematics class may serve to promote achievement in other mathematics classes by changing the way students feel about mathematics as a discipline.

Summary

Findings from the research literature which investigated students' attitudes towards mathematics utilizing quantitative, qualitative, and mixed methods approaches were reviewed in this section. Improvement on academic performance of its students has become the primary focus of American education. The main focus of this study is the examination of influencing factors on student performance in mathematics. Research suggests a positive relationship exists between students' attitudes towards mathematics (i.e., how much they value, enjoy, have confidence in and are motivated to learn mathematics) and learning mathematics successfully (Ma, 2000; Martino & Zan, 2010; Nordell, 2009). Both value and enjoyment are critical aspects of metacognition and self-regulated study which are fundamental in promoting learning to learn.

Study skills instruction is a valued tool in increasing academic success in mathematics. If students are to become more successful, it becomes imperative for educators to seek out and employ instructional strategies to assist students in learning how they learn and apply techniques that work for them. Students need to experience success through self-regulated study and metacognition. This study seeks to add to the knowledge of learning techniques in mathematics by examining whether or not embedding study skills in algebra classes impact students' attitudes toward the discipline. The next section will outline the specific methods which were used to carry out the study.

Section 3: Research Method

The purpose of this study was to examine the effects of embedded study-skills instruction on ninth and 10th grade students' attitudes toward mathematics. A mixed methods design was used to concurrently test the effects of the intervention on students' attitudes and understand, from the student perspective, why students' attitudes changed. Specifically, a nonequivalent (pretest/posttest) control group design was used to test the effects of embedded study-skills instruction in Algebra I class (i.e., independent variable) on students' attitudes toward mathematics (i.e., dependent variable). According to district policy, there were two Algebra I classes using embedded study-skills instruction for a semester (18 weeks) and two Algebra I classes not using embedded study-skills instruction. Data from the Attitudes Toward Mathematics Inventory (ATMI), a district-administered inventory, were used to assess these Algebra I students' pre and post attitudes toward mathematics in four domains: (a) self-confidence, (b) value, (c) enjoyment, and (d) motivation (Marsh, 2004; Tapia, 1996; Tapia & Marsh, 2002). In addition, qualitative interviews were used to explore students' perceptions of why possible changes in attitude occurred. The purpose of the quantitative sequence in the study was to test the hypothesis that embedded study-skills instruction affects students' attitudes toward mathematics, whereas the purpose of the qualitative portion was to explore how and in what ways the study-skills instruction affects these attitudes. Specifically, this study examined the effects of embedded study-skills instruction on the students' (a) self-confidence in mathematics (confidence); (b) value placed on mathematics (value); (c) level of enjoyment in mathematics (enjoyment); and (d) motivation to learn mathematics (motivation).

Section 3 describes the specific methodology used to conduct the study. Data collection included the use of a survey (i.e., quantitative method) and interviews (i.e., qualitative method). This section is presented in related subsections, namely research design, which includes a presentation of the research questions, population, and researcher's role. Next, a description of the specific treatment used is discussed. After this discussion, the sequence of the mixed methods used in the study is presented, along with the procedures to obtain permission to conduct the investigation as well as collect data. The remaining topics discussed in this section include data analysis and validation for both quantitative and qualitative data. Finally, a summary of the information described in Section 3 is presented.

Research Design and Approach

This study used a mixed methods sequential, explanatory design. As explained by Creswell (2009), this research design has two phases: One involves the collection of data to answer quantitative questions, and one involves answering qualitative research questions. In this design, a qualitative approach was used to confirm and cross-validate the findings from the quantitative phase (Creswell et al., 2003). The data from both phases were integrated during analysis. Once the analysis of the quantitative data was complete, analysis and interpretation of the qualitative data were performed. Due to the nature of the study, an investigation of the current literature supporting mixed methods research designs in mathematics was reviewed.

Ross and Onwuegbuzie (2010) conducted an extensive review of the trends in mathematical research for over two decades and reported that mixed methods investigations were more prevalent than purely quantitative or qualitative investigations. Mathematics education researchers are currently more inclined to examine behaviors, thinking patterns, and understanding, in addition to quantitative results; that is, mixed method studies have become more prevalent in mathematics research than either qualitative or quantitative research designs alone (Ross & Onwuegbuzie, 2010) due to the nature of the types of understandings being sought. This notion is especially important, in this instance, because the study sought to examine not only students' attitudes toward mathematics and whether changes occurred in these attitudes, but also why these changes occurred from the student perspective. Therefore, a mixed methods approach was used.

Sequential Explanatory Strategy

The strategy for the study was the sequential explanatory strategy. According to Creswell (2009), the sequential explanatory strategy is selected as a model when a researcher uses qualitative results to assist in explaining and interpreting the findings of a primarily quantitative study. Within the study, the quantitative data collection and analysis took place prior to the qualitative data collection technique. The priority was given to the quantitative data, with integration occurring in the interpretation phase of the study. As explained by Creswell, the convergence of findings from both data collection techniques can strengthen the knowledge gained from the study, or at least can help others (e.g., researchers and practitioners) understand why the convergence of the findings was not possible.

Quantitative and Qualitative Approaches

Quantitative methods have been described as empirical investigations that entail systematic computational, mathematical, or statistical methods used to obtain information through mathematical models (or theories) to answer such questions as when, what, and where about the phenomenon under investigation (Baron, Branscombe & Byrne, 2009; Beins, 2005; Creswell, 2009). In other words, this approach would show the connection between mathematical expressions of quantitative data and observations from empirical research (Creswell, 2009). Quantitative research is also used to test specific hypotheses. Examples of quantitative methods are (a) the use of surveys (or questionnaires, which are both sometimes referred to as *inventories*), (b) physiological measures, (c) psycho-physiological measures, (d) behavioral checklists, (e) naturalistic observations, (f) and structured interviews that record responses on specific scales such as the Likert, Thurstone, or Bogardus Social Distance scales, after specific manipulations of the independent variable (Beins, 2005; Baron et al., 2009). After the manipulation (or variation of the independent variable), the dependent variable would be recorded through the use of those types of numerical data (Baron, Branscombe, & Byrne, 2009; Creswell, 2009). In addition, quantitative data are normally analyzed through the use of descriptive or inferential statistics and other parametric procedures (Beins, 2005; Creswell, 2009).

The quantitative portion of the study used a quasi-experimental design (nonequivalent pretest/posttest with control group) to test whether attitudes toward mathematics of students taking algebra with embedded study skills were significantly different from those of students taking algebra without embedded study-skills instruction.

The pre/post attitude data were obtained from the district's administration of the Attitudes Toward Mathematics Inventory (ATMI) developed by Tapia (1996). This instrument has been reliably used in past and current research (Marsh, 2004). Furthermore, the ATMI appears to be an acceptable means to obtain information about students' perceptions of mathematics as measured by their levels of confidence, value, enjoyment, and motivation in relation to mathematics (Marsh, 2004; Tapia & Marsh, 2004). In this instance, specific comparisons can be made between the responses of the control and experimental (i.e., treatment) groups. This type of quantitative data collection method is appropriate for the collection of information (e.g., experiences or perceptions) from a sample in an efficient and reliable manner (Creswell, 2009). The reason why a quantitative method was used in this instance was because it could be used to fulfill one of the major objectives for this investigation, namely to measure student attitudes toward mathematics across four domains in order to determine if a significant difference existed in the attitudes of ninth and 10th grade students who had received embedded study-skills instruction when compared to those students who had not received the instruction.

In contrast, qualitative inquiry methods have been used to obtain more detailed information than obtained with quantitative data, which could help researchers understand the behavior of people as well as the reasons why people behave as they do. As explained by Creswell (2009), the qualitative approach is used to answer such questions as why and how people respond as they do. Therefore, a smaller sample size is used with the qualitative approach (Beins, 2005). In this instance, the qualitative method provided information about specific cases being investigated, which yielded knowledge from the perspective of the participants studied (Denzin & Lincoln, 2005). Examples of qualitative data sources that have been used include case studies, interviews (structured, unstructured, clinical—or semistructured), observations (e.g., with researcher serving as a participant or nonparticipant observer), group discussions (or small or large focus groups), field notes, and archival data such as pictures, texts, or other written documents (Denzin & Lincoln, 2005; Marshall & Rossman, 1998).

The qualitative interview technique was used in the study to obtain more in-depth information about how and why the use of embedded skills instruction may or may not change students' attitudes toward mathematics. As explained by Hatch (2002), this qualitative method has been used by researchers to describe and understand participants' experiences and views of their worlds. More information is provided about the use of this approach in the section on the sequence of the mixed methods.

As stated previously, the quantitative approach was given priority in this investigation. It was in the interpretation phase that the results from both methods were integrated (Creswell, 2009). The convergence of the findings from both paradigms serves to strengthen the knowledge gained from the study or, at the very least, may help others (e.g., researchers and practitioners) understand why the convergence of the findings was not possible.

Setting and Sample

Setting

The setting for this study was one high school located in a southern county in Georgia. This school district served approximately 5,000 students in the 2011-2012 academic year. A sample was drawn from Summer High School within this district serving over 1,500 students in Grades 9 through 12 in a rural environment. There were approximately 500 students who entered high school as ninth grade algebra students in the academic year 2012-2013.

Demographics of the students in the targeted school showed, just as in the school district, that the majority of the students were African American, with Caucasian Americans being the second largest group (see Table 1). As seen in Table 1, 70% of the students were African American, and 21% of the students were Caucasian. A large percentage (62%) of the students received free or reduced-price lunch. Table 1 shows that the targeted school is representative of the district in terms of the demographics of the students it serves. Thus, the sample is representative of the ninth grade students in the district.

Table 1

Demographics of Students Served in District and School

Race/ethnicity	School district	Summer H.S.
Black	74.0%	70.0%
White	17.0%	21.0%
Hispanic	04.0%	03.0%
Asian	02.0%	02.0%
Multiracial	02.0%	03.0%
American Indian	< 0.1%	< 0.1%

Sample

Through the use of teacher recommendations and previous course grades, the entering ninth grade students are placed into three levels of algebra: (a) those needing additional support, (b) those considered on-level, and (c) those who are accelerated. Because the school was concerned with the number of students not being successful in Algebra I, the focus became those students who had to repeat the course for a second time. The sampling frame of this study was the list of classes composed of those students who were enrolled in one of the Algebra I classes for a second time (i.e., approximately 40 students). Two classes representing the treatment group and two classes representing the control group were selected to participate. Because the classes were selected based upon availability and teachers' schedules, a nonprobability sampling technique (convenience sampling) was used. The Algebra I classes in which embedded study-skills instruction occurred were referred to as the treatment group, and the other Algebra I classes in which no embedded study-skills instruction took place were referred to as the control group.

In terms of the sample's size, approximately 30 students were planned for the treatment group and 30 students were planned for the control group. Power analysis was performed to determine the appropriate sample size for the groups (Beins, 2005; Creswell, 2009; Ellis, 2010). The calculations were based on the level of significance (i.e., .05), amount of power preferred in the study (i.e., .80), and the expected or estimated effect size, which refers to differences expected in the means between the treatment group and the control group. The effect size is expressed in standard deviation units (i.e., .50). As a result of these decisions, it was determined at least 26 participants needed to be in each group.

Students eligible for participation in this study were those enrolled in an algebra course (Algebra I) for the second time. These students were also considered by state guidelines to still be on track to meet high school graduation requirements for mathematics. In addition, the teachers of participating students in the treatment group (i.e., two classes) had undergone training in college readiness emphasizing study skills instruction, whereas teachers of students in the control group (i.e., two classes) had not received any formal study-skills instruction training. Participants in the study were ninth and 10th grade Caucasian and African American students who were enrolled in the Algebra I course for the second time, with an average age of 15 years.

Researcher's Role

I have a nonsupervisory role in the school and no control over the work of the teachers or students. I was trained in AVID strategies and currently am a full-time program manager for AVID Center's Eastern Division working closely with district personnel to assess the professional development needs of the staff as those needs pertain to AVID professional development offerings. The opportunity to conduct the study was provided from my experience as a former mathematics teacher and currently in a supporting role for the AVID programs in Georgia. The decision was made to implement the study in a school where I had never worked as a teacher or department chair so no accusations of coercion, favoritism, or unethical behaviors could be presented. Plans for the study required me to collect data from the school and conduct interviews with approximately 10 students from the treatment group. A data release form was signed and released by the school, and a copy was filed with me. Data were stored in a locked file cabinet in my office. All electronically filed data were stored on my password-protected computer. I was both systematic and objective and served solely as a researcher at the discretion of the school leaders. The goal was to ensure that all participants were treated professionally and in accord with acceptable standards for conducting research with human participants (National Institute of Health, 2004, 2005).

Treatment

The focus of this study was on the effects of embedded study-skills instruction on students' attitudes towards mathematics. Educational leaders in collaboration with the teachers in the school made the decision to use the embedded study skills in designated classrooms as a regular part of the curriculum after being exposed to strategies and best practices through the AVID College Readiness training. During the treatment phase (i.e., first 12-week grading period) of the study, the treatment was administered as a regular part of the curriculum in both classrooms concurrently so that the study-skills strategies were taught to the students at the same time (classes are held for 50 minutes each day). The study-skills strategies emphasized in the AVID College Readiness System were used to instruct students in the study of mathematics. That is, the independent variable was the use of the embedded study-skills plan, which included the use of the Cornell note-taking method, binder organization, and a collaborative tutorial process. More specifically, the teacher for the treatment groups (i.e., two classrooms) provided students with embedded instruction on the use of the Cornell note-taking method, binder organization, and the use of the AVID tutorial process.

Specifically, the AVID Tutorial is a 10-step process using collaborative inquiry to facilitate learning as a regular part of the mathematics curriculum in designated classrooms. The process begins and ends with an emphasis on Cornell note taking for the mathematics course. The 10 steps are divided into the roles and responsibilities of students and teachers before, during, and after the tutorial. For example, before the tutorial, the student is responsible for taking Cornell notes during the class and choosing a higher level question to present at the tutorial; that is, the student is expected to challenge him- or herself. After the student presents the question to the group, it becomes the responsibility of the other students in the group to ask questions to increase the student presenter's understanding of the material. The teacher facilitates the mathematics class by observing the learning process and interjecting with guiding questions when necessary. This tutorial process prepares students for the early development of study groups (Watt, Powell, Mendiola & Cossio, 2006). As the teacher for the treatment group was trained in AVID methodologies, he was familiar with the tutorial process and used this methodology biweekly during the treatment period. Students in the control group were those whose teacher did not embed these study-skills strategies in the mathematics classroom. Although these students were taught the mathematical concepts required by the state of Georgia, like the students in the experimental group, they did not have direct instruction on the use of the embedded study-skills strategies.

Sequence of Mixed Methods

Quantitative Sequence

Both groups of students (i.e., treatment and control groups) completed the Attitudes Toward Mathematics Inventory (ATMI, see Appendix A), as part of normal district procedure, at the beginning of the treatment phase which will be within the first ten days of the semester, and after the participation in the embedded skills instruction classes . The ATMI was used to assess students' attitudes towards mathematics in four domains: (a) enjoyment, (b) motivation, (c) self-confidence, and (d) value (Marsh, 2004; Tapia, 1996; Tapia & Marsh, 2002). The school administered the inventory to mathematics students who were enrolled in the Algebra I course for the second time and collected the data for their own use. Because students are accustomed to taking diagnostic tests and inventories at the beginning of the semester, the district chose to administer the initial ATMI during the first ten days of the semester in their mathematics classrooms. Students were allotted 30 minutes for completion of the ATMI. After completion of the ATMI, the school district forwarded the de-identified data to me.

The ATMI is composed of 40-items (Marsh, 2004; Tapia & Marsh, 2004). Designed to obtain information about students' attitudes toward mathematics, this instrument has been used with middle or high school students (Marsh, 2004; Tapia & Marsh, 2004). Response options utilize the commonly used Likert type scale. When using a Likert scale, respondents indicate their level of agreement ranging from strongly disagree to strongly agree. With regards to the ATMI, participant responses to each item were scored so the value 1 is assigned to a response of "*strongly disagree*," 2 is assigned to a response of "*disagree*," 3 is assigned to a "*neutral*," 4 is assigned to the response *"agree*," and the value 5 is given to a response of "*strongly agree."* Participants' scores are summed to form the sub-scale variables self-confidence, value, enjoyment and motivation according to the sub-scales from which the item came. Some items are scored in the reverse due to their wording. For instance, for the item: studying mathematics makes me nervous, from the sub-scale self-confidence, a score of 5 would correspond to "*strongly disagree"*, and 1 would correspond to "*strongly agree"*. Table 2 indicates the ATMI response options. The higher the score the student reports on the Inventory, then the greater the level of agreement for that particular domain. Sample questions for each domain are subsequently described.

Table 2

ATMI Response Options

Values Assigned to Responses	1	2	3	4	5
	Strongly disagree	*Disagree*	*Neutral*	*Agree*	*Strongly Agree*
Values Assigned to Reverse Responses	1	2	3	4	5
	Strongly Agree	*Agree*	*Neutral*	*Disagree*	*Strongly disagree*

ATMI self-confidence. This subscale is composed of 15 items used to assess the students' level of self-confidence in mathematics. Some of the actual items from the inventory include: (1) "studying mathematics makes me feel nervous," (2) "I am always under a terrible strain in math class," (3) "I am able to solve mathematics problems without too much difficulty" (Tapia &Marsh, 2004).

ATMI value. This subscale consists of 10 items used to measure the value students place on mathematics. Some of the actual items from the inventory include: (a) "mathematics is important to everyday life" (b) "mathematics is one of the most important subjects for people to study" (c) "high school math courses would be very helpful no matter what I decide to study" (Tapia &Marsh, 2004).

ATMI enjoyment. This subscale has 10 items used to assess the students' level of enjoyment for mathematics. Three of the sample items from the actual inventory include: (a) "I have usually enjoyed studying mathematics in school" (b) "mathematics is dull and boring" (c) "I am happier in math class than in any other class" (Tapia &Marsh, 2004).

ATMI motivation. There are five items for this subscale. These questions are used to assess the students' level of motivation to learn mathematics. Three of these items from the actual inventory include: (a) "I would like to avoid using mathematics in college" (b) "I am willing to take more than the required amount of mathematics" (c) "I plan to take as much mathematics as I can during my education" (Tapia &Marsh, 2004).

The reliability and validity of the ATMI has been assessed and determined to be acceptable (Amirali, 2010; Marsh, 2004; Tapia, 1996; Tapia & Marsh, 2002). Internal consistency of the ATMI was reported as .97 (Tapia, 1996). Acceptable levels of content validity, construct validity, as well as reliability coefficients have also been determined (Tapia & Marsh, 2002). According to Tapia and Marsh, reliability coefficients (i.e., Cronbach alphas) for each of the four subscales are as follows: .87 for the Self-Confidence subscale, .78 for the Value subscale, .86 for the Enjoyment subscale, and .76 for the Motivation subscale (Tapia, 1996). Other studies have continued to show the ATMI is a valid and reliable instrument (Amirali, 2010; Marsh, 2004; Tapia & Marsh, 2002).

Tapia and Marsh (2004) recommended the Attitudes Toward Mathematics Inventory (ATMI) as a sound instrument to assess the attitudes students hold toward mathematics. One of the patterns revealed in the literature (and described in detail in Section 2) was that students' attitudes toward mathematics would influence their performance in mathematics (Chouinard & Roy, 2008; Grootenboer & Hemmings, 2007; Ma, 2002; Portal & Sampson, 2001). In the development of the ATMI, Tapia and Marsh indicated the instrument was designed to assess factors research had shown to be components of the attitude construct.

Qualitative Sequence

Gaining access to participants. Participants were contacted once approval had been secured from the school district representative. Informed Consent forms were disseminated to all students in the treatment group immediately following the district's second administration of the ATMI. Six parents consented to their children's participation in the study. Students signed assent forms at the time of the group interviews. These six students were asked to take part in group interview sessions conducted by me.

Researcher-participant working relationship. As an employee of the AVID organization, I assist district liaisons in providing professional learning opportunities for the staff at AVID sites. These professional learning opportunities' primary focus is to increase college readiness for all students on campus. Since I do not have any control or direct supervision of the teachers or students, it is believed I was viewed as a nonthreatening educational assistant. I have a credible relationship with the research site. The study was conducted in a professional and ethical manner. Students and teachers were thanked for their information and cooperation.

Semi structured group interviews. Qualitative data collection consisted of interviews with the students to obtain their views on the importance of study skills and how knowledge of the study skills affected their attitude towards mathematics. 6 students were interviewed in two group interview sessions (3 students in each session). According to Hatch (2002), qualitative researchers use interviews "to uncover the meaning structures that participants use to organize their experiences and make sense of their worlds" (p. 91). The interviews were designed to provide more insight into the students' perceptions of the incorporation of the study skills that may support (or verify) the findings of the quantitative data.

Each group interview session lasted approximately 40–50 minutes. The interview sessions began with reading the assent form which states the purpose of the interview, participation is voluntary, and the participant may withdraw at any time. Students consented by signing the assent forms. A written interview guide or interview protocol was used to facilitate the interviews. The questions were designed to provide insight into the students' perceptions as a learner in using study skills that may support or refute the findings of the quantitative data. Students was asked to respond to the 10 questions which addressed the students' use of study skills and the effect the study skills had on their attitudes towards mathematics. The interviews provided insight regarding the impact of embedded skills instruction on the students' attitudes towards mathematics. In addition, a description of findings was presented in the qualitative analysis.

Data triangulation. Because there is research suggesting the use of different standards when judging the quality of qualitative research versus quantitative research, Creswell (2009) suggested several strategies may be used to improve the quality of findings when conducting qualitative research. Among these strategies are triangulation, a rich thick description, and clarification of researcher bias.

This study uses a mixed methods research design which enables the compilation of both quantitative and qualitative data. Information was collected about the students' attitudes towards mathematics from students who are enrolled in classrooms which used embedded instructional strategies. In addition, information was collected from the students in group interview sessions. As such, information from the use of the ATMI and the interviews was used to illustrate support for the findings obtained. According to Creswell (2009), different sources of data can be used to help explain the results obtained in a study as well as justify the themes, patterns, or meanings identified**.**

The study also utilized a rich, thick description to convey the findings. Creswell and Miller (2000) note a rich, thick description is "a procedure for establishing credibility by describing the setting, the participants and the themes of a qualitative study in rich detail" (p. 128). Therefore, a description was crafted to establish credibility through the lens of the reader by presenting the information in a way in which the reader feels he is experiencing the event. Additionally to reduce researcher bias, an audit trail was kept outlining all research steps taken from start to finish of the project (Lincoln & Guba, 1985). The audit trail will consist of all raw data, written field notes, and any notes taken when analyzing data.

Measures Taken for Participants' Rights

The rights of the participants were protected and respected. After obtaining the appropriate approvals (i.e., Dissertation Committee, Institutional Review Board, school district, and principal), the study was explained to the mathematics teachers. Parents of the student participants in the interview sessions were provided informed consent prior to the being selected to participate. The distribution of consent forms took place immediately following the administration of the ATMI.

The study was not designed to put any of the students at risk psychologically, physically, legally, socially, or economically (Creswell, 2009). Concern was expressed because the participants were minors; therefore, permission of the parents was obtained for those students who participated in the interview sessions. Furthermore, parents were given contact information for the chair of the dissertation committee, Walden University's Institutional Review Board, and me in case they had any concerns about the study. Measurements taken to ensure protection of participants' rights were described in the consent form which also included an explanation of the study's purpose and procedures. In addition, details of what was expected of the participants were presented.

Since their students' participation is voluntary, they were reminded they can withdraw from the study at any time without penalty.

The privacy of the participants was protected at all times. Ethical standards were maintained (Beins, 2005; Creswell, 2009; Walden University, 2009). For instance, the students' names were not recorded and none of the information collected was used to identify the students as individuals. Numerical codes were assigned to identify whether the participants were in the treatment or control group. For example, a code of one (1) was used for the control group and a code of two (2) was used for the experimental group (e.g. control group = 1, 101-121; experimental group = 2, 201-226.

Data Collection Procedures

Attitudes Toward Mathematics Inventory (ATMI)

The school site used the Attitudes Toward Mathematics Inventory (ATMI) as a means of measuring the attitudes of 9^{th} and 10^{th} grade Algebra I students. Typically all diagnostic testing and inventories are done within the first 10 days of a semester; therefore, the first administration of the inventory took place within the first 10 days and the second administration followed after 12 weeks of administering the treatment. The school assumed all responsibilities for administering the ATMI and collecting the data. Once the data release agreement had been secured, the school shared the data with me. Once received, raw data were secured in a locked file cabinet in my home office. Data were filed electronically and stored on a password-protected secure, computer software program in the Statistical Package of the Social Sciences (SPSS), which belongs to me. As an additional security measure, the electronically filed data were downloaded and stored to an external hard drive (flash drive) and stored in the locked file cabinet located in my office.

Semi structured Group Interview Sessions

After the second administration of the ATMI, 6 students were given an opportunity to participate in semi structured group interview sessions. Those students willing to participate were asked to sign an assent form outlining voluntary participation and explaining their right to not respond to specific questions. Specific open-ended questions were used to stimulate discussions in the interviews (see Appendix B). I was able to concentrate on the responses made by the participants because of the following planned actions: (1) remind the students why they are being interviewed, (2) review the purpose of the study, and (3) request their verbal permission to audiotape the sessions. The interview sessions occurred on a day and time designated by the teachers after completion of the second administration of the ATMI. The expectation was for the sessions to be scheduled during the students' homeroom period or other non-instructional time. Demographic information (i.e., sex, age, grade, and race/ethnicity) was collected to provide general characteristics of the sample.

Data Analyses and Validation

Quantitative Analyses: Research Questions 1-4

This study gathered data used to answer four quantitative research questions. These questions include: (a) Is there a difference in self-confidence levels between students receiving embedded study skills instruction in Algebra I and students who do not receive embedded study skills instruction? (b) Is there a difference in the value of mathematics between students receiving embedded study skills instruction in Algebra I and students that do not receive embedded study skills instruction? (c) Is there a difference in the level of enjoyment for mathematics between students receiving embedded study skills instruction and students that do not receive embedded study skills instruction? And (d) Is there a difference in the motivation to learn mathematics between students receiving embedded study skills instruction and students that do not receive embedded study skills instruction? The research questions were also restated as hypotheses.

To analyze data related to these questions, students' responses on the ATMI were recorded and placed (i.e., data input) into the Statistical Package for the Social Sciences (SPSS), Version 17.0 (George & Mallery, 2009). First, the participants' responses to the survey questions were recorded as prescribed by the ATMI (Tapia & Marsh, 2004). Participants were asked to respond through the use of a five-point Likert scale: *Strongly disagree* = 1, *disagree* = 2, *neutral* = 3, *agree* = 4 and *strongly agree* = 5. As indicated by Tapia and Marsh, 12 of the items on the ATMI were reversed (i.e., a score of 5 becomes a score of 1, etc.). Measures of confidence, enjoyment, motivation and value were obtained by summing the scores on the items corresponding to each subscale. Second, the statistical software was used to generate descriptive statistics on the data collected and the students' demographics. The independent variable was the use of embedded study skills instruction and the dependent variables were the students' responses on the ATMI.

To test the hypotheses I planned to use a Multivariate Analysis of Covariance (MANCOVA; Beins, 2005; George & Mallery, 2009) to determine whether embedding study skills strategies in the algebra curriculum had a significant effect on the students' attitudes towards algebra. The MANCOVA is used when there are multiple dependent variables. The dependent variables are the four variables of confidence, enjoyment, value, and motivation. This method was selected because of the need to control for any possible pretest differences between the experimental and control groups, as well as control the overall alpha level in the study. Moreover, a MANOVA is used when examining the effects of one independent variable, embedded study skills, on multiple dependent variables at the same time (George & Mallery, 2009). The probability level of .05 was used to determine if a significant difference between attitude toward mathematics in students in the control and experimental groups exist. If any significant difference exists, then subsequent univariate analysis (ANOVA) are used to examine any patterns of changes in the students' attitudes towards mathematics as a result of embedded study skills instruction.

Qualitative Analysis: Research Question 5

The qualitative research question is: How does embedded study skills instruction influence students' attitudes toward Mathematics? Six students volunteered to participate and were given an opportunity to participate in a group interview session with me. Information collected from the interviews was used to respond to research question number five. The interview sessions used open-ended interview questions to obtain further insight into why and how the treatment influences students' attitudes towards mathematics. Interviews were audio taped and later transcribed by me (Creswell, 2009; Janesick, 2004; Rubin & Rubin, 2005). The primary goal was to identify the content or concepts, themes, and patterns of the participants' responses to determine how embedded study skills instruction influenced their attitude towards Algebra.

Creswell (2009) described acceptable standards for analyzing qualitative data. As required, the data are prepared for analysis, analyzed, and interpreted by the researcher. Data analysis and validation will follow Creswell's procedures as follows: (1) transcribe the audiotape from the individual interviews so the information can be organized and prepared for analysis; (2) review data to obtain an overall sense of the information provided by the participants as a response to the interview questions; consider the meaning, knowledge, impression, and tone of information provided; (3) chunk (i.e., code based on content) information together to identify substance; use the actual language of the participants; (4) use information provided by the participants to describe the sample; (5) present information in narrative form; (6) summarize the basic understanding of the data to report how the participants explained the way embedded study skills influenced their attitudes toward Mathematics; and (7) validate the information obtained from the interviews. Information provided by the participants was coded using the open and axial coding techniques (Glaser & Strauss, 1967) and described using the specific terms reported by the participants (i.e., verbatim).

To validate information obtained from the participants, Creswell (2009) recommends the use of member checking. Member checking involves me repeating information to the participants to ensure she or he has heard what was said correctly. For instance, to bring closure to the interviews I reviewed the major topics discussed by the participants to ask them if my interpretation of what was said was accurate, as well as to clarify any points necessary. Additionally, students were asked for any final comments or questions they wanted to provide. This component of the research process provided information that further explains the findings obtained through the use of the survey regarding how the embedded study skills instruction influence students' attitudes toward mathematics. These measures are those Creswell identified as critical for the validation of qualitative data.

Another means of ascertaining the credibility of qualitative research is to use the process of peer debriefing (Guba & Lincoln, 1985). According to these authors peer debriefing is "a process of exposing oneself to a disinterested peer in a manner paralleling an analytical session and for the purpose of exploring aspects of the inquiry that might otherwise remain only implicit within the inquirer's mind" (Lincoln & Guba, 1985, p. 308). The structure of the Walden University dissertation committee mimics this process by ensuring at least three knowledgeable educational professionals review the study to provide input and question the assumptions and findings. Using feedback from these professionals will strengthen the trustworthiness of this study.

Summary

The purpose of this study was to examine the effects of embedded study skills strategy instruction on ninth grade students' attitudes towards mathematics. A mixed methods, concurrent triangulation research design was used to test the effects of embedded study skills instruction into Algebra I class (i.e., independent variable) on 9^{th} and 10^{th} grade students' attitudes toward mathematics (i.e., dependent variable). The Attitudes Toward Mathematics Inventory (ATMI) was used to assess students' attitudes towards mathematics in four domains: (1) enjoyment, (2) motivation, (3) self-confidence, and (4) value (Marsh, 2004; Tapia, 1996; Tapia & Marsh, 2002). The control group was asked to complete the ATMI during the same time periods as the experimental group. There were two Algebra I classes that used embedded study skills instruction and two Algebra I classes that did not use embedded study skills instruction.

There were four quantitative research questions addressed and four related hypotheses tested. Descriptive statistics and the Multivariate Analysis of Covariance (MANCOVA) was planned to determine if the embedded study skills instruction (i.e., independent variable) influenced the students' attitudes toward mathematics as measured by the ATMI (i.e., dependent variables). Semi structured group interviews were used to collect information that can be used to respond to the qualitative research question. Ten open-ended questions were used to help generate discussions in the structured interviews. This method was used to help provide insight into the students' attitudes toward mathematics as a result of the use of study skills instruction in the Algebra I class. This study afforded mathematics educators another avenue to having a positive impact on how students perceive mathematics and its importance.

Section 4: Findings

This study was designed to examine the effect of embedded study-skills instruction on students' attitudes toward mathematics. Data were collected to respond to five research questions (i.e., four quantitative questions and one qualitative question) and test four hypotheses. The research questions were as follows:

1. Is there a difference in self-confidence levels between students receiving embedded study-skills instruction in Algebra I and students who do not receive embedded study-skills instruction?
2. Is there a difference in the value of mathematics between students receiving embedded study-skills instruction in Algebra I and student who do not receive embedded study-skills instruction?
3. Is there a difference in the level of enjoyment for mathematics between students receiving embedded study-skills instruction and students who do not receive embedded study-skills instruction?
4. Is there a difference in the motivation to learn mathematics between students receiving embedded study-skills instruction and students who do not receive embedded study-skills instruction?
5. How does embedded study-skills instruction influence students' attitude toward mathematics?

The four hypotheses related to the four quantitative research questions, stated in the null and in the alternative, were as follows:

H_0: There is no statistically significant difference in self-confidence level between students receiving embedded study-skills instruction in Algebra I and students who do not receive embedded study-skills instruction.

H_1: There is a statistically significant difference in self-confidence level between students receiving embedded study-skills instruction in Algebra I and students who do not receive embedded study-skills instruction.

H_0: There is no statistically significant difference in the value of mathematics between students receiving embedded study-skills instruction in Algebra I and students who do not receive embedded study-skills instruction.

H_1: There is a statistically significant difference in the value of mathematics between students receiving embedded study-skills instruction in Algebra I and students who do not receive embedded study-skills instruction.

H_0: There is no statistically significant difference in level of enjoyment of mathematics between students receiving embedded study-skills instruction in Algebra I and students who do not receive embedded study-skills instruction.

H_1: There is a statistically significant difference in level of enjoyment of mathematics between students receiving embedded study-skills instruction in Algebra I and students who do not receive embedded study-skills instruction.

H_0: There is no statistically significant difference in motivation to learn mathematics between students receiving embedded study-skills instruction in Algebra I and students who do not receive embedded study-skills instruction.

H_1: There is no statistically significant difference in motivation to learn mathematics between students receiving embedded study-skills instruction in Algebra I and students who do not receive embedded study-skills instruction.

Data were collected to address each research question and test each hypothesis. The pre/post attitude data were obtained from the district's administration of the Attitudes Toward Mathematics Inventory (ATMI) developed by Tapia (1996). The ATMI assessed the participants' attitudes toward mathematics in four domains: (a) value, (b) enjoyment, (c) self-confidence, and (d) motivation.

The ATMI is composed of 40-items (Marsh, 2004; Tapia & Marsh, 2004). Participants responded to these items, indicating their level of agreement ranging from *strongly disagree* to *strongly agree*. Participant responses to each item were scored so that the value 1 was assigned to a response of *strongly disagree*, 2 was assigned to a response of *disagree*, 3 was assigned to *neutral*, 4 was assigned to the response *agree*, and the value 5 was given to a response of *strongly agree*. Participants' scores were summed to form the subscale variables self-confidence, value, enjoyment, and motivation according to the subscales from which the item came. Some items were scored in the reverse due to their wording. Therefore, if a participant assigned a value of 1 to a reversed item, it would be summed as 5, a value of 2 was reversed to 4, and a value of 3 remained the same. On the ATMI (see Appendix A), items numbered 1–10 were used to assess the value participants placed on mathematics. Items 9 and 10 were scored in the reverse for this subscale. Items numbered 11-20 were used to calculate the participants' level of enjoyment for mathematics as measured by the ATMI. Items scored in the reverse were numbers 11, 12, 13, 14, 15, and 20. Questions 21–35 were the items used to calculate the self-confidence domain (or subscale) of the ATMI. Items 21, 25, and 28 were scored in the reverse. The items used to calculate the subscale of motivation on the ATMI were Items 36-40. No items were scored in the reverse for this subscale. Data analyses and the findings for the research questions and hypotheses are discussed in the following sections after the description of the sample is provided. Furthermore, a rationale for the change in the quantitative data analysis is described.

Demographics of Participants

Participants were high school students enrolled in Algebra I classes for the second time. Participants in the Algebra I class in which embedded study-skills instruction occurred were labeled as participants in the treatment group, and participants enrolled in the Algebra I class in which embedded instruction did not occur were labeled as participants in the control group. Participants were administered the Attitudes Toward Mathematics Inventory (Tapia & Marsh, 2004) per the school's guidelines. There were two administrations of the ATMI. The first (pretest) was prior to the treatment group receiving embedded study-skills instruction, and the second (posttest) was after 12 weeks of instruction.

Table 3

Distribution of Participants Across Tests and Conditions

Test	Condition	Frequency
Pretest	Control group	12
Posttest	Control group	9
Pretest	Treatment group	16
Posttest	Treatment group	10

As can been seen in Table 3, a total of 28 students completed the initial ATMI, with 19 of them continuing and completing the final administration of the ATMI. Student data not included in the analyses were from students who (a) no longer attended the classes, (b) went to in-school suspension three or more times during the semester, and (c) missed more days in class than they attended. Therefore, the participant numbers decreased for the posttest. A total of 28 students, 12 in the control group and 16 in the treatment group, participated in the initial administration of the Attitudes Toward Mathematics Inventory (ATMI) and provided demographic information.

Table 4 shows the distribution of male and female students across the treatment conditions and groups. As can be seen, the majority of the participants were males (75%) in the control group. On the contrary, there were more female (62.5%) participants in the treatment group. Most of the participants reported African American as their ethnicity.

Table 4

Demographics of the Participants: Groups by Gender

Gender	Control		Treatment	
	Frequency	%	Frequency	%
Male	9	75	6	37.5
Female	3	25	10	62.5
Total	12		16	

Table 5 shows the ethnicity of participants across conditions. It can be seen that the majority of the participants were African American in both the control and treatment groups. The majority (83.3%) of the participants in the sample were in the 10th grade during the study. The mean age for the overall sample was 15.9 years.

Table 5

Demographics of Participants: Groups by Ethnicity

Race/Ethnicity	Control		Treatment	
	Frequency	%	Frequency	%
African American	11	91.6	12	75
Caucasian American	1	8.4	2	12.5
Mixed race	0	--	2	12.5
Total	12		16	

Specific findings from the ATMI are presented after a discussion of the rationale for the analysis and results from the pretest measures.

Rationale for Analysis

The MANCOVA, planned for the quantitative analysis in the Analysis section, was not used because the pre and post test data received from the district were not paired. That is, the data were given to me as anonymous pre and post survey data, with no student code linking the pre response with the post response for the same student. Without such a link, the pre attitude variables could not be used as covariates in a statistical analysis. The assumption in such an analysis is that there is a linear relationship between the covariate and the dependent variable (Stevens, 1996). Therefore, a series of independent sample *t* tests was used instead to first compare the means of the pre variables and then to test the means of the post variables.

Pretest Measures

To determine if there were any pretest attitude differences between the control and treatment groups, a *t* test was run in SPSS on the four pre variables: value, enjoyment, self-motivation, and confidence. Results of the four independent samples *t* test revealed a significant difference between the groups (i.e., control and treatment) on the pretest measures (i.e., before embedded study-skills instruction) of value and motivation as indicated by the ATMI. As can be seen in Table 6, the control group's mean scores were higher than the treatment group's on all variables with the exception of self-confidence. In addition, there were significant differences favoring the control group on both value and motivation prior to receiving the treatment. There was no significant difference between the control and treatment groups on enjoyment and self-confidence.

Table 6

Results of t Test and Descriptive Statistics for Groups on the Pretest as Measured by the ATMI

	Control (n = 12)		Treatment (n = 16)			
	M	*SD*	*M*	*SD*	*t*	*df*
Value	43.08	7.13	38.25	4.96	2.12*	26
Enjoyment	27.67	9.41	26.13	6.49	.514	26
Self-confidence	44.75	12.16	47.63	12.38	-.613	26
Motivation	18.42	4.23	15.25	2.38	2.33*	16

The next section provides a rationale for the analyses conducted on the post attitude variables of interest and the findings for each research question.

Data Analyses and Findings for Each Research Question

To test the hypotheses that the embedding of study-skills strategies into the algebra curriculum has a significant effect on students' attitudes toward algebra, independent *t* tests were performed. This test is used when comparing the mean of one sample with the mean of another to determine if there is a significant difference (Gravetter & Wallnau, 2005). This method was selected because it enabled the examination of the effects of one independent variable, embedded study skills, by comparing the means of two independent samples (the experimental and control groups).

The probability level of .05 was used to determine if a significant difference in attitude toward mathematics existed between students in the control and treatment groups.

Research Question 1

The first research question asked was as follows: Is there a difference in self-confidence levels between students receiving embedded study-skills instruction in Algebra I and students who do not receive embedded study-skills instruction? To respond to this research question, participants' responses to the self-confidence items on the ATMI were computed and the participants' levels of self-confidence reported in the control group were compared to those of the treatment group.

An independent samples *t* test was conducted to compare the self-confidence levels of students who received study-skills instructions with those of their counterparts who did not receive study-skills instruction. Results showed that there was no significant difference in the self-confidence scores of those students who were enrolled in the embedded study-skills instruction Algebra I class (i.e., treatment group) and their counterparts who were not enrolled in the embedded study skills Algebra I class (i.e., control group). Table 7 shows the results of the *t* test on the self-confidence variable as measured by the ATMI.

Table 7

Results of t Test and Descriptive Statistics for Self-Confidence Across Groups

	Groups						
	Control (n = 9)		Treatment (n = 10)				
	M	*SD*	*M*	*SD*	*df*	*t*	Sig.
Self-conf.	45.78	16.61	45.82	10.13	17	-.006	.995

As can be seen in Table 7, no statistically significant difference existed between the treatment and control groups on the self-confidence variable. Therefore, the null hypothesis was not rejected, and it was concluded that there were no differences in self-confidence between students who had had study-skills instruction and those who had not.

Research Question 2

The second research question asked was as follows: Is there a difference in the value students place in mathematics between students receiving embedded study-skills instruction in Algebra I and students who do not receive embedded study-skills instruction? Similarly to the pretest results for this variable, results of the *t* test revealed a significant difference in the student's value of mathematics between the control group and the treatment group; see Table 8.

Table 8

Results of t Test and Descriptive Statistics for Value

	Groups						
	Control (n = 9)		Treatment (n = 10)				
	M	*SD*	*M*	*SD*	*df*	*t*	Sig.
Value	46.56	9.37	37.22	5.11	17	2.74	.014*

As can be seen in Table 8 above, a statistically significant difference exists between the control and treatment groups on the value variable. Therefore, the null hypothesis was rejected and its alternative was accepted. Specifically stated, there was a statistically significant difference between the value of mathematics and group membership. That is, students in the control group reported a significantly higher value of mathematics than did students in the treatment group (p = .01). This difference was also observed before the students participated in embedded study skills instruction (see Table 6). As seen in the pretest measures (Table 6), before the students participated in embedded study skills instruction, the mean for the group was 38.25. After participation in embedded study skills instruction, the treatment group reported a value level for mathematics of M = 37.22. It is interesting to note these students' value of mathematics: (a) decreased slightly after participation in embedded study skills instruction, and (b) was less than those students in the control group (i.e., had not participated in embedded study skills instruction). No data were collected to directly access the reason for this finding, however, it was speculated students feelings about mathematics were made more salient as a result of participation in the embedded study skills instruction program. As related to the differences between groups, the argument here is even though the treatment group's value level for mathematics was lower than the control group's value level for mathematics, students in the treatment group still valued mathematics. Further analyses (i.e., qualitative data) supported this explanation and will be discussed in the appropriate section. These data indicated students who participated in embedded study skills instruction actually valued mathematics and were able to articulate the importance of mathematics in their lives today as well as in the future.

Research Question 3

Research question three asked: Is there a difference in the level of enjoyment in mathematics between students receiving embedded study skills instruction and students who do not receive embedded study skills instruction? An independent-samples *t*-test revealed no significant differences between the responses of the control group and the treatment group on level of enjoyment for mathematics; see Table 9. Patterns from the scores of the treatment groups' level of enjoyment were slightly lower than the control groups' level of enjoyment however; this difference was not significant therefore the null hypothesis was accepted. There was no significant difference in the students' level of enjoyment of mathematics for students who received embedded study skills instruction and those who did not.

Table 9

Results of t Test and Descriptive Statistics for Enjoyment

	Groups						
	Control (*n* = 9)		Treatment (*n* = 10)				
	M	*SD*	*M*	*SD*	*df*	*t*	Sig.
Enjoyment	28.44	9.21	27.72	4.68	17	.220	.828

Research Question 4

Research question four asked: Is there a difference in the motivation to learn mathematics between students receiving embedded study skills instruction and students who do not receive embedded study skills instruction? As shown in Table 10, a *t* test revealed there was a not a significant difference in the scores for students who received embedded study skills instruction and students who did not.

Table 10

Results of t Test and Descriptive Statistics for Motivation Across Groups

	Groups						
	Control (*n* = 9)		Treatment (*n* = 10)				
	M	*SD*	*M*	*SD*	*df*	*t*	Sig.
Motivation	19.67	4.82	16.46	2.48	17	1.85	.081

Therefore, the null hypothesis was accepted. There was no significant difference in the motivation to learn mathematics between students who received embedded study skills instruction and students who did not receive embedded study skills instruction. It should be recalled however that control group participants reported scores (*M* = 18.42) which indicated they were more motivated than were participants in the treatment group (M = 15.25) during the pretest, and these differences were significant (see Table 6). After participants in the treatment group were exposed to embedded study skills instruction, their level of motivation increased slightly. This increase was enough to eliminate any significant differences between the two groups on the posttest. Specifically, there were no significant differences on motivation for mathematics between the treatment group and the control group during the posttest as shown in Table 10.

Research Question 5

The last research question was qualitative. Qualitative research is used to obtain a deeper meaning of the information (than obtained from quantitative research) to help better understand the phenomenon under investigation (Creswell, 2009). This research question enabled me to obtain information regarding the perceptions of the participants about embedded study skills instruction used in an Algebra I class. Specifically, the goal was to obtain information directly from the students to determine how embedded study skills instruction influenced students' attitude towards mathematics. Six students agreed to participate in two, group interview sessions. Three participants were interviewed in each session. Four females, three of whom were African American and one Caucasian American, and two males (both African American) were participants in the group interviews. Most of the respondents in the small group interview sessions were in the 9th grade (n = 5); and one was a 10th grader. In addition, four (or 66%) of this subgroup completed the course with success, that is, earned final grades between 85% - 100%. Due to concerns about confidentiality, no further information is available about this group of students.

Questions used to stimulate discussions in the semi-structured interviews are presented in Appendix B. I welcomed the participants in each session and after obtaining their permission to record the session, began the session. The audio-taped responses were used to begin the analysis of the qualitative portion of the study.

First, transcriptions of the audiotaped group interview sessions were conducted to organize the data and prepare for analysis. Next, data were reviewed to obtain an overall sense of the information as related to the meaning, knowledge, impression, and tone of information collected. Following this review process, the transcripts were coded. As discussed in section three, information provided by the participants was coded using the open and axial coding techniques (Glaser & Strauss, 1967) and presented in the specific terms reported by the participants, that is, verbatim, as described by Creswell (2009). The next step involved developing information into narrative form followed by summarizing a basic understanding of the data to reveal the participants' perceptions about the way embedded study skills instruction influenced their attitudes toward mathematics.

To determine how embedded study skills instruction in the Algebra I class influenced students' attitude towards mathematics (i.e., research question five), participants were asked 10 questions from the previously developed Interview Protocol (see Appendix B). The first question was reflective in nature and allowed students to detail their experiences with study skills strategies. Additional questions followed to target how participants felt about the specific study skill use in the Algebra I class. Results from these items are subsequently presented.

Experiences with embedded study skills. When participants were asked to discuss their experiences with [embedded] study skills this semester, their responses in their own words were varied. However, the participants' responses could be divided into two categories: (1) how they studied, and (2) tools they used to study. Table 11 shows the categories along with examples for the two categories revealed from the participants' responses and stated in their own words. The experiences with embedded study skills instruction reported by the students included the following: (a) call friends and ask them how to do stuff to get a better understanding, (b) note taking was different, (c) write the problems down and practice at home, (d) memorize, (e) just studied, (f) used notes, flash cards, online games and stuff, (g) have Grams or someone read over my notes and try to quiz me on them; or I cram right before a test, and (h) notebook, binder.

Table 11

Identified Categories of Experiences With Embedded Study Skills as Reported by Participants

Themes	Examples of responses
How they studied	1. Collaboratively (Study Partners): Call friends and ask them how to do stuff to get a better understanding; have Grams or someone read over my notes and try to quiz me on them; and 2. Individually: Cram before a test; just studied, memorize, write the problems down and practice at home
Tools used	Note taking was different, used notes, flash cards, online game and stuff, notebook, binder

Based on the participants' responses, I followed up with another question to further clarify the participants' experiences with study skills. Because of my familiarity with the protocol used with embedded study skills instruction, the participants were asked about different aspects of their experiences, as well as how it helped them. Specifically, participants were asked to describe their experiences with the: (1) Cornell note-taking process, and (2) use of binders for mathematics class. Their responses are subsequently described in the following two sections.

Use of Cornell note-taking process. When participants were asked to elaborate on different aspects of embedded study skills instruction, they were first asked about the Cornell note taking process. Participants' responses could be placed in two categories, that is, their experience with the Cornell note-taking process enabled them to: (a) organize their notes, and (b) better understand their notes. One participant stated "It just helps me keep all of my notes organized and everything so I won't have to look for anything because it's all in one place," (Research Participant 5). Research Participant 3 stated "It helped me decipher notes and make it easier to understand." When this participant was asked to explain how Cornell note taking made it easier for her to understand, she stated "How I usually write notes, I write down on a piece of paper and I don't know which way it goes, to separate the information…How the notes are set up [makes it easier]." "I write everything down" said Research Participant 1. The Cornell Note taking method also emerged as a strategy with an impact on how students learn mathematics.

Overall, participants' responses indicated they had experienced different teaching styles and used different learning styles. They reported over the years different mathematics teachers had used different teaching methods which enabled them to use different learning styles (i.e., flash cards, online games, collaborative learning, and visuals). However, Research Participant 4 explained how the Cornell Note taking method impacted his learning. He said

> At first it was kinda hard because before you didn't have to do it [Cornell note taking process], but once you got used to doing it, you could get your notes and see examples, and [with] examples you get a visual picture of what's going on.

In sum, responses emerging from participants in the group interviews showed their experiences with the Cornell note taking process served to help them organize their notes and understand the notes.

Use of binder for mathematics class. When participants were asked to discuss their use of binders for mathematics class, they provided details about the different ways they actually organized their binders in their math class. Examples of the specific responses from the participants were: Research Participant 6: "I have a three subject binder, on one I have due now, the other one class work, and the third section I keep all notes in it." According to the participant, do nows are activities they complete upon entering the mathematics classroom. Research Participant 4 said "I have a binder. I put like notes in the ring part and then I have a folder for work sheets and everything else just a notebook." Research Participant 5 "I put [notes] behind other stuff when I get it, do nows, notes." Research Participant 2: [I put] "Notes on one side, work sheets, home work on the other." Research Participant 3: [The binder helps you keep up with your work, without the binder] "It [the work] is not in any order. Basic location, all in the binder, [it's] the central location." It appears the participants in the group interviews believe the binders they use for the mathematics class have a positive impact on their organizational skills.

Workload in math class. When the participants were asked to talk about their workload in mathematics this semester, the responses were mixed. The responses showed some of the participants stated they: (a) had a lot of work, (b) did not have a lot of work and (c) had somewhat more work this semester than in the previous semester. In addition, a theme that evolved throughout the responses of the participants' discussion of embedded study skills instruction is the importance of and benefits from organization. Additionally, the researcher prompted the participants with the following statements, "Let's talk about the workload in math. How much work you had to do? Do you think it was a lot?" In one of the small group interview sessions, one participant said, "Yes," the other said "No" and the third said, "Somewhat." I asked each participant to elaborate on their responses, for instance, why did you say it was a lot, why not a lot and why somewhat. The participant who said he thought it was a lot explained it in this manner, "If I have to use this number to get this number and then use that number to get that…That's a lot because I'm not processing it all at the same time" (Research Participant 1). The participant who said he thought it was not a lot reported the following "[It's] not really all of that" (Research Participant 2). Then the participant who said somewhat explained, "I had a class that gives us a lot, it's not a lot now compared to the class I had in the 4th block. He gave us a quiz every week, so it's not really a lot of additional work [in this class]."

Five out of the six participants discussed this item, and the remaining two participants stated the work load was okay. Research Participant 5 said, "This [semester] I am more organized than last semester." Research Participant 6 said, "He [the teacher] doesn't pile on all of the work and have it all done on one day so it makes it easier. We get an assignment and we get it done before he assigns us another one" (Research Participant 6). I followed up for further clarification with the question, "So with study skills in math, do you think that some of the study skills you have been introduced to make it seem a little easier to work with?" Research Participant 6 said, "Yes, definitely."

Mathematics: Self-Confidence, Value, Enjoyment, and Motivation

The next four questions were used to obtain information about the perceptions of the participants regarding embedded study skills instruction and their levels of the following: (a) self-confidence, (b) value of mathematics, (c) enjoyment of mathematics, and (d) motivation to learn mathematics. It was previously reported there were significant differences between the control group's and treatment group's value and motivation levels in the pretest session. These differences did not emerge between the two groups during the posttest, except in the case of the value of mathematics. It was believed the responses from the students in the group interview sessions would provide insight into these findings. Results obtained from the small group interview sessions (i.e., qualitative data) about these variables are subsequently described.

Embedded study skills and self-confidence. I asked the participants to think about the embedded study skills and their confidence. I continued with the following statement, "…From the beginning of the semester, before you got any information, do you feel better prepared with those study skills, are you more confident about math at all...like getting note taking, getting your binders together?" Responses from the research participants indicated most of the participants believed the embedded study skills instruction had increased their levels of self-confidence about mathematics. One participant said, "I think confidence comes from being able to understand it." When I asked "Do you think study skills helped with that?" the participants said, "Yes." Another participant provided a cogent example about her level of confidence in mathematics after being enrolled in the embedded study skills instruction Algebra I class. Research Participant 6 said, "It [embedded study skills instruction] prepared me more for what was going on." I then asked, "So you think it made you more confident?" Research Participant 6, "The study skills helped a lot. I told [Mr. Teacher's Name] the other day that I felt really good being able to help my Dad with his algebra homework!" Overall, the primary theme revealed from the participants' responses was the embedded study skills instruction helped them feel more confident about their ability to be successful in mathematics. One student indicated he did not have any problems with mathematics if it was taught appropriately so he did not feel the embedded study skills instruction contributed to his confidence about mathematics.

Embedded study skills and value of mathematics. I asked the participants to talk about the value of mathematics outside of the classroom as a result of being exposed to embedded study skills instruction. In essence, responses indicated that when the value of mathematics was discussed the participants valued mathematics more as a result of embedded study skills instruction than before they were exposed to this instructional method. This finding is inconsistent with the results obtained from the quantitative data. In that instance, the value of mathematics for participants in the treatment group was slightly lower after participation in embedded study skills instruction (M = 37.22; see Table 7) than it was for this group before participation in embedded study skills instruction (M = 38.25; see Table 5). When I asked the participants why they think they placed more value on mathematics now than a year ago, Research Participant 4 explained, "Because I understand it more I know what to use it for…with our age we are about to start work, and we need math to be able to function." Participants agreed: (a) math was more important to them now, and (b) the value of math had changed after embedded study skills instruction. Research Participant 1 explained, "Some things involved math that you need to know." Examples of things you needed to know mathematically outside of the classroom given by Research Participant 2 were financial problems and insurance payments. Even though there were significant differences between the control and the treatment groups' value of mathematics at the posttest, indications from the group interview sessions revealed these students valued mathematics more after embedded study skills instruction because they understood mathematics better. As previously stated, they also reported math was important in their lives.

Embedded study skills and enjoyment. The pattern of the responses from the participants revealed they do feel embedded study skills instruction helped them enjoy mathematics more, because they feel more comfortable with completing the task and more confident they can complete the assignment. Only one participant stated he did not enjoy mathematics any more than before embedded study skills instruction because he had always enjoyed mathematics. Research Participant 4 explained, "It's a lot more fun when you know what you are doing. Just knowing you can do something like kind of close to a challenging problem, like…If you understand the small part of the problem you can do it." Research Participants 1 stated "At some point it's difficult, then sometimes you know that you are ready to go on." Participant 1 agreed, when you get to the challenging part now, compared to last year, math is more fun. Other responses from the participants indicated one believed there was somewhat more enjoyment after embedded study skills instruction, and another participant stated the level of enjoyment was the same. Research Participant 3 said it was not more fun now because "I always liked math."

Embedded study skills and motivation. Participants were asked to think about and discuss whether or not they thought embedded study skills instruction served to motivate them to learn mathematics. In sum, the majority of the participants stated embedded study skills instruction increased their level of motivation for math. Only one participant said embedded study skills instruction did not increase motivation to learn math, because he was already motivated and study skills did not contribute to his level of motivation to learn mathematics. As discussed previously, even though there were significant differences reported between the control group and the treatment group during the pretest (see Table 5), this difference was not shown during the posttest (see Table 9).

It is possible participation in embedded study skills instruction served to slightly increase the level of motivation for the treatment group to the point there were no significant differences between the control group and treatment group at the posttest. Support for this speculation came from the fact the level of motivation to learn math by the treatment group increased slightly (M = 16.46) at the posttest from the pretest scores (M = 15.25). Furthermore, during the group interview sessions all of the participants except one stated embedded study skills instruction increased their level of motivation for math.

Most influential aspects of embedded study-skills instruction. Finally, participants were asked to specifically describe the aspects of the embedded study skills instruction they thought was the most helpful and least helpful. Participants' responses fell into two categories. Either they said everything they learned was helpful, or they reported there was nothing they would label as least helpful. There were two aspects of study skills instruction participants reported helped them most. These aspects were either directly or indirectly related to their enhanced performance in mathematics class. As shown in Table 12, students were able to identify aspects of the embedded study skills instruction and were aware they helped them improve their performance in mathematics. In terms of the least helpful, the participants agreed everything in the embedded study skills instruction was helpful and there was nothing that could be described as the least helpful.

I asked the participants to clarify a few of their responses. For instance, when the participants said they liked the note taking method when learning about slopes, intercept, area and perimeter, Research Participant 2 explained, "Certain problems that you need formulas to do. Mr. [Teacher's Name] would make sure you had them; and you could remember them." When I asked the research participant to explain how her teacher motivated her, she said "The way he motivated me, [was when he explained how] he went through school [graduated] and did everything to become a mathematician, so, it's like, I can do that, you know."

Table 12

Aspects of Embedded Study-Skills Instruction that Helped the Most as Reported by Participants

Embedded study skills instruction	
Directly related	Indirectly related
1. Showed me a new way, it showed me how I learned math better	1. I think the best thing we have done is work with each other (e.g., quizzing each other, explaining problems)
2. Having notes helped, note taking	2. Ask questions if they don't understand
3. Being able to review your notes, to look over them, to look over them and understand them and stuff	3. The way my teacher motivated me.
4. The methods helped the most (e.g., different ways to work out problems made it easier)	4. Everything contributed, everything helped
5. Methods were best (e.g., the way they taught you how to do slopes, intercept, area, perimeter)	

The last question I asked in both small group interview sessions was for the students, based on their experiences, to share their thoughts about what they believed could help another teacher teach math. Responses from the participants suggested students believe helpful teachers are those who: (a) are supportive, (b) engage them in learning, and (c) are patient. The specific comments made by the participants were: (a)

"Have teacher interact and help you [with an assignment] rather than after they tell you [what to do], they expect you to know right away [how to complete the assignment]" (Research Participant 1); (b) "Some teachers get mad when they have to re-explain something," (Research Participant 3); and (c) "The way we can all go to [our teacher] and ask questions and he is willing to answer them," (Research Participant 4). Clearly some students are able to identify what strategies in the classroom they feel are helpful to them. To complete the group interview sessions, the participants were asked if they had any other comments or questions and thanked for their participation.

Evidence of Quality

Several considerations were taken to reduce threats to validity and quality in both the quantitative and qualitative portions of this study. The quantitative instrument, ATMI, was a valid and reliable instrument used to measure students' attitudes towards mathematics in four domains (i.e. self-confidence, value, enjoyment, and motivation). The same ATMI was administered at the beginning and end of the treatment phase to determine the measure of growth. Data input and statistical analysis was performed and reviewed several times for accuracy. Additional considerations were given to the qualitative portion of the study. Following Creswell's (2009) acceptable standards for qualitative data analysis and validation, interview data were transcribed, reviewed, chunked, summarized, and presented in narrative form. Additionally, information was coded using open and axial coding techniques (Glaser & Strauss, 1967). Lastly, to reduce researcher bias, an audit trail (Creswell, 2009) consisting of raw data, written field notes, and any notes taken while analyzing data, was maintained.

Outcomes

The results of this mixed methods study indicated no significant differences in 9th and 10th grade algebra students' attitudes toward mathematics after receiving embedded study skills instruction on three of the four variables of the ATMI. Therefore, the null hypotheses were accepted for the self-confidence, level of enjoyment, and motivation constructs as measured by the ATMI. However, an important result of the analysis indicated that there were pre-test differences in the students in the control group's and treatment group's motivation favoring the control group but these differences were no longer evident in the post test results. One significant difference was found in the quantitative analysis. The significant difference was found in the students' value of mathematics after receiving embedded study skills instruction; however, the significant difference was favoring the control group as it had in the pretest analysis. The treatment group only showed a slight decrease in the mean after the treatment. This analysis resulted in the rejection of the null hypothesis because there was still a significant difference in the students' value of mathematics after receiving embedded study skills instruction favoring the control group.

Two themes emerged from an analysis of student responses to investigate how embedded study skills instruction influenced students' attitudes toward mathematics. First, students feel more confident, organized, and able to complete mathematical tasks or assignments when taught to utilize focused note taking (i.e. Cornell note taking) and binders for organization. Students reported the Cornell note taking method helped them to understand the math better and although the process was difficult to grasp at first, they soon learned the process and used the notes to study. Students also reported keeping notes and assignments in a binder gave them easy access to assignments and study materials (i.e., notes). Second, students feel more confident about mathematics because of an increase in their understanding of the subject after being taught embedded study skills strategies. Students reported feeling confident that they could be successful in the algebra class once they better understood the use of notes and were given an opportunity to work collaboratively with others when studying. Student participants noted being able to quiz each other and provide explanations for problem solving contributed to their increased understanding of algebra. The next section presents summaries of the findings along with the conclusions and recommendations.

Section 5: Discussion, Conclusions, and Recommendations

Overview of the Study

The purpose of this mixed methods study was to examine the effect of embedded study-skills instruction on high school students' attitudes toward mathematics as measured by Tapia and Marsh's (2004) Attitudes Toward Mathematics Inventory (ATMI). A mixed methods investigation was designed in which participants were asked to (a) respond to the ATMI on two separate occasions (pretreatment and posttreatment) and (b) participate in two small group interview sessions. The sample included a total of 28 students who were enrolled in the Algebra I classes during the time period for the completion of this investigation (i.e., were able to participate in the pretest and posttest phases of the study). However, some of the students did not remain in the classes for the full time of the investigation. A sample size of 120 students (60 in the courses that implemented study skills and 60 in the control group that did not implement study skills) was anticipated; however, the school site decided to only administer the ATMI to students who struggled in algebra and were enrolled in the class for the second time. Therefore, the sample used in this study was smaller than anticipated, with a total of 28 student participants (16 in treatment group and 12 in control group). Because a smaller sample size was used, the quantitative sequence of the study was underpowered (i.e., low probability of identifying an effect of concrete significance should one actually exist), and results should be treated tentatively. The majority of the participants who responded were African American and male, and the average age was 15.9 years. Data collected from the participants revealed that they were in Grades 9 and 10. Most of the participants were in the 10th grade (81.6%). Data were also obtained that showed that 66% (i.e., the majority) of the students who participated in the small group interview sessions and 36% of the students who responded to the ATMI successfully (i.e., grades of 85%-100%) completed the Algebra I course. This result is consistent with past research indicating that when schools make special efforts to respond to the needs of their students (i.e., use intervention strategies), most often, positive student outcomes emerge (Aydin & Ubuz, 2010; Baum & Ma, 2007; Ellis, 2003; Jacobs, 2008; Martinez & Klopott, 2005; National Center for Educational Statistics, 2009; National Mathematics Advisory Panel, 2008).

Because the focus of this study was on students' attitudes toward mathematics as a result of being enrolled in an Algebra I class in which embedded study-skills instruction occurred, it was decided that the best approach was to obtain information through the use of the ATMI (Tapia & Marsh, 2004) and to conduct group interviews with randomly selected students. The ATMI is an attitude instrument administered to the Algebra I students through the school site. The ATMI was designed to assess participants' attitudes in four domains: (a) self-confidence about mathematics, (b) value of mathematics, (c) enjoyment of mathematics, and (d) motivation to learn mathematics. As such, four quantitative research questions guided the work conducted in this study, along with four related hypotheses.

On the surface of this investigation, it would appear that experience with embedded study-skills instruction in an Algebra I class did not influence students' attitudes toward mathematics measured quantitatively. However, as a mixed methods approach was used, an opportunity to generate discussions about the students' experiences with embedded study skills instruction was provided. Findings obtained in the group sessions revealed support for a positive influence of embedded study-skills instruction on attitudes toward mathematics, although no significant differences were found in the quantitative measures for students who experienced embedded study-skills instruction. Conclusions drawn from the results of testing the hypotheses of the research questions are discussed in the subsections that follow.

Interpretation of Findings

Quantitative Research Questions

Question 1. The first research question asked if there was a difference on the self-confidence subscale between the treatment group and the control group before and after students in the treatment group had been enrolled in an embedded study-skills instruction Algebra I class for 12 weeks. It was believed that the comparison of the treatment group's level of self-confidence to the control group's level of self-confidence both pre and post treatment was the most direct approach to obtain information that could be used to address Research Question 1. Results from the analysis did not reveal any significant differences in the self-confidence domain of the ATMI between the students who were enrolled in an embedded study-skills instruction Algebra I class (i.e., treatment group) and their counterparts who were not enrolled in an embedded study-skills instruction Algebra I class either before or after the intervention. As no differences were found between groups on the pre self-confidence measure, a valid comparison could be made between the groups after the intervention. No differences were found after administration of the treatment; therefore, it was concluded that the embedded study-skills intervention had no effect on student self-confidence as measured by the ATMI.

Question 2. Research Question 2 asked if there was a difference between the treatment group's (i.e., embedded study-skills instruction) and control group's (i.e., no embedded study-skills instruction) value of mathematics. The independent *t* test conducted on the pretest value variable indicated a significant difference in the value of mathematics between students receiving embedded study-skills instruction in Algebra I and students who did not receive embedded study-skills instruction, favoring the students in the control group. The *t* test conducted on the post value variable found the same difference between students receiving embedded study-skills instruction in Algebra I and students who did not receive embedded study-skills instruction, also favoring the students in the control group. Both before and after the intervention, participants in the control group (pre M = 43. 08; post M = 46.6) valued mathematics significantly more than participants in the treatment group (pre M = 38.25; post M = 37.2). This finding can be interpreted as indicating that the intervention had no effect on student value of mathematics.

Question 3. Research Question 3 focused on participants' reported level of enjoyment for mathematics. Because there was no indication of a significant difference among the groups in the pretest, the results of the posttest revealed an accurate account of the effect of embedded study-skills instruction on students' level of enjoyment. Results of the posttest showed that there was no significant difference in the level of enjoyment for mathematics between the treatment group (i.e., students receiving embedded study-skills instruction) and control group (i.e., students who did not receive embedded study-skills instruction). The means for the treatment group (M = 27.7) and control group (M = 28.4) were not significantly different; therefore, embedded study-skills instruction had no effect on students' enjoyment of mathematics.

Question 4. Lastly, the response to the final quantitative research question (i.e., Research Question 4) was that there was no significant difference in the motivation to learn mathematics between the treatment group (i.e., students who received embedded study-skills instruction) and control group (i.e., students who did not receive embedded study-skills instruction). Although the pretest measures indicated a significant difference in the two groups' motivation to learn favoring the control group, the posttest did not indicate a significant difference. These findings indicate that there was an increase in motivation for the students who received embedded study-skills instruction such that the existing difference between groups during the pretest was eliminated.

Qualitative Research Question

As expected, information obtained in the small group interview sessions was more informative than information obtained from the ATMI (Creswell, 2009; Gravetter & Forzano, 2012). For instance, the only significant difference revealed in the analyses was the significant difference on the value of mathematics subscale between the control group (M = 46.6) and the treatment group (M = 37.2). In this instance, after a 12-week period, the control group participants' reported scores on the value of mathematics subscale were significantly higher than those of participants in the treatment group; this difference was not in the expected direction. However, information was obtained and used to respond to the fifth research question, which was a qualitative research question. Research question 5 asked the following: How does embedded study-skills instruction influence students' attitude toward mathematics?

Six students who were selected agreed to participate in the group interview sessions. Two group interview sessions were held to collect information to respond to the fifth research question. A semi structured interview was conducted with three participants in each group. This subgroup of students can be described as 84% African American and 16% Caucasian American. There were four females (66.6%) and two males (33.4%). Most of the respondents in the small group interview sessions were in the ninth grade (83.3%), and one (or 16.7%) was in the 10th grade. As stated previously, it was also determined that 66% of this subgroup completed the course with success—that is, earned final grades between 85% and 100%.

To determine how embedded study-skills instruction in the Algebra I class influenced students' attitude toward mathematics (i.e., research question 5), participants were asked 10 questions. The questions focused on students' experiences with embedded study skills, including how embedded study skills supported the way they learned and impacted the four attitude domains (self-confidence, value, enjoyment, and motivation) being measured on the ATMI. Results for these items are subsequently summarized.

Participants' experiences with embedded study skills were varied. Most students reported a change in their study behaviors after receiving embedded study-skills instruction. For example, students reported that they began to work with others or collaborate more when studying. Students also reported that they were using their notes when getting assistance from peers or family members. Additionally, students were able to articulate experiences with the note-taking process and how it influenced their learning.

Overall, participants reported that Cornell note taking had a positive influence on learning mathematics. The ability to organize one's thoughts and ideas is one of the metacognitive skills that greatly impacts learning in mathematics (Stel & Veenman, 2010). Students interviewed cited the benefits of Cornell note taking for their organizational skills. Two themes emerged from participants' responses—namely, the Cornell note taking process helps students (a) organize their notes and (b) understand the notes. These findings are consistent with those published by Jacobs (2008) regarding the positive influence of Cornell note taking on students' attitudes toward mathematics and achievement in mathematics. Additionally, participant responses provided insight into how they learned as it pertained to their learning style and note taking.

Students reported behaviors that support the concept of learning to learn, which reflects an assumption that teachers help students to develop study-skills strategies for self-regulated learning (Bembenutty, 2008; Cornford, 2002; Waeytens, Lens, &Vanderberghe, 1997). Participants' responses regarding how embedded study skills instruction supported the way in which they learned indicated that they had encountered teachers who used different methods that focused on different learning styles (e.g., flash cards, online games, collaborative learning, and visuals), but this class was different. Students felt that they were given the tools needed to develop better study habits so they could be more involved with their learning. For instance, Research Participant 4 indicated that the note-taking was method was new to him. He said,

> At first it was kinda hard because before you didn't have to do it [Cornell note-taking process], but once you got used to doing it, you could get your notes and see examples, and [with] examples you get a visual picture of what's going on.

It appears that when students were able to express themselves and elaborate on their perceptions about embedded study-skills instruction, more information was obtained, which provided a better understanding how Cornell note taking influenced learning.

There were also four questions used to obtain information about the perceptions of the participants regarding embedded study skills instruction and their (a) self-confidence, (b) value of mathematics, (c) enjoyment of mathematics, and (d) motivation to learn mathematics as measured by the ATMI (Tapia & Marsh, 2004). The only significant finding from the quantitative analyses was the difference between the treatment group's (i.e., students enrolled in the embedded study skills instruction Algebra I class) and the control group's (i.e., students who were not enrolled in the embedded study skills instruction Algebra I class) value of mathematics. The *t* test conducted on the pretest value variable indicated a significant difference in the value of mathematics between students receiving embedded study-skills instruction in Algebra I and students who did not receive embedded study-skills instruction, favoring the students in the control group. The *t* test conducted on the posttest value variable found the same difference between students receiving embedded study-skills instruction in Algebra I and students who did not receive embedded study-skills instruction, also favoring the students in the control group. Both before and after the intervention, participants in the control group (pre *M* = 43. 08; post *M*= 46.6) valued mathematics significantly more than participants in the treatment group (pre *M* = 38.25; Post *M* = 37.2). Therefore, the quantitative analysis indicated that the intervention had no effect on students' value of mathematics. However, in interviews with the participants from the group receiving the treatment, responses indicated that they valued mathematics more after receiving the embedded study-skills instruction. For example, Research Participant 4 explained that (s) he placed more value on mathematics after participating in this class because (s) he understood mathematics more and knew that mathematics is needed to function in society. This finding is consistent with Amirali's (2010) research regarding students' conceptions about the value and usefulness of mathematics in everyday life.

Participants indicated that embedded study-skills instruction helped them enjoy mathematics more because they now had strategies to help them understand the class work and homework better. Only one participant stated that the level of enjoyment had not changed because he had always enjoyed mathematics. Similarly, when participants discussed whether or not they thought embedded study-skills instruction served to motivate them to learn mathematics, the majority of them answered affirmatively. Only one student responded that he did not experience an increase because he had always been motivated to learn mathematics.

The last question posed to the students asked them to share their thoughts about the practices they believed could help a teacher teach math more effectively. Feedback from students about their learning experiences in the classroom could be helpful for teachers when determining the best instructional practices to embed in their lessons. In this study, the participants' feedback indicated that they learned better from teachers who interacted with them more through questioning, exhibited patience when explaining a process, and were approachable when they experienced difficulty in completing an assignment.

Overall, the findings from this study are applicable to the development of instructional strategies that increase students' metacognitive skills. Students began to think about how they learn and actually think about thinking. Therefore, students were making strides toward becoming self-regulated learners with increased levels of understanding. With knowledge of the study's findings, mathematics teachers will be able to develop and employ strategies that have a positive impact on students' attitude toward mathematics.

Implications for Social Change

Results of this study may effect social change by addressing the problem of American students not being successful in mathematics. Public education in the United States continues to face challenges in student achievement in mathematics, which have implications on an even larger scale in the international arena (Hanushek et al., 2010). Even though some progress has been made, too many of America's youth are not able to make adequate yearly progress in the area of mathematics (Change the Equation, 2010; Georgia Department of Education, 2011; National Center for Educational Statistics, 2009). Specifically, this study contributes to the existing body of knowledge on mathematics education regarding metacognitive effectiveness, lays a foundation for future research, and benefits students by identifying study skills that contribute to metacognitive skillfulness.

Recommendations for Action

As stated, results of this study indicated that students' attitudes toward learning mathematics was impacted positively when study skills strategies were embedded into the algebra curriculum. This knowledge will benefit mathematics educators when creating learning environments that support the affective domain through embedded study skills strategies. Therefore, educators should be afforded professional learning opportunites that increase awareness of how embedded study skills instruction impacts student learning and be encouraged to embed the strategies into lessons.

Recommendations for Further Study

Results of this study answered five questions concerning the effect of embedded study skills instruction on high school students' attitudes toward mathematics. These results also generated areas for future research. Specifically, areas for future study may include investigating how embedded study skills instruction effects first time algebra students' attitude toward mathematics and varying demographic groups of students' attitude toward mathematics.

While this study provided helpful and insightful information regarding students' experiences with embedded study skills instruction, the sample consisted of students who were taking algebra for the second time after being unsuccessful the previous semester. This also limited the sample to a much smaller size ($n = 28$) hence affecting the power of the study. Further investigation with a sample size of at least 52 would be needed to provide stronger quantitative evidence that embedded study skills instruction had an impact on attitude toward mathematics as measured by the ATMI.

Conclusion

There is a decline in students pursuing higher-level math courses that prepare them for majors and careers in science, technology, engineering, and mathematics (Hill, Corbett, & St. Rose, 2010; Zelkowski, 2010). If we are to compete successfully in a highly technological global society, it is essential for educators to work towards increasing not only the mathematical skills of all students but their interest and desire to pursue the subject as well. One way educators can work towards increasing study in the area of mathematics is to take a closer look at factors that contribute to students' developing a more positive attitude toward the subject.

The primary goal of this study was to examine factors that may affect students' attitude towards mathematics whereby providing educators with effective tools to increase students' desires to pursue higher levels of mathematics. As reported, qualitative findings from this study support the notion that embedded study skills instruction has a positive influence on students' attitudes toward mathematics. With this in mind, educators are encouraged to embed study skills instruction into the mathematics curriculum. The implications for the future standing of America to other nations are clear. If students do not pursue careers in fields that require higher levels of mathematics, the United States is unlikely to have a workforce that would respond to the needs of our ever changing society.

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Appendix A: Attitudes Toward Mathematics Inventory (ATMI)

Directions: This inventory consists of statements about your attitude toward mathematics. There are no correct or incorrect responses. Read each item carefully. Please think about how you feel about each item. Darken the circle that most closely corresponds to how the statements best describes your feelings. Use the following response scale to respond to each item.

PLEASE USE THIS SCALE TO RESPOND TO EACH ITEM

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

1. Mathematics is a very worthwhile and necessary subject. _______
2. I want to develop my mathematical skills. _______
3. I get a great deal of satisfaction out of solving a mathematics problem. _______
4. Mathematics helps develop the mind and teaches a person to think. _______
5. Mathematics is important in everyday life. _______
6. Mathematics is one of the most important subjects for people to study. _______
7. High school math courses would be very helpful no matter what I decide to study. __
8. I can think of many ways that I use math outside of school. _______
9. Mathematics is one of my most dreaded subjects. _______
10. My mind goes blank and I am unable to think clearly when working with mathematics. _______
11. Studying mathematics makes me feel nervous. _______
12. Mathematics makes me feel uncomfortable. _______
13. I am always under a terrible strain in a math class. _______
14. When I hear the word mathematics, I have a feeling of dislike. _______
15. It makes me nervous to even think about having to do a mathematics problem. ____
16. Mathematics does not scare me at all. ______________
17. I have a lot of self-confidence when it comes to mathematics. _______
18. I am able to solve mathematics problems without too much difficulty. _______
19. I expect to do fairly well in any math class I take. _______
20. I am always confused in my mathematics class. _______
21. I feel a sense of insecurity when attempting mathematics. _______
22. I learn mathematics easily. _______
23. I am confident that I could learn advanced mathematics. _______
24. I have usually enjoyed studying mathematics in school. _______
25. Mathematics is dull and boring. _______
26. I like to solve new problems in mathematics. _______
27. I would prefer to do an assignment in math than to write an essay. _______
28. I would like to avoid using mathematics in college. _______
29. I really like mathematics. _______
30. I am happier in a math class than in any other class. _______
31. Mathematics is a very interesting subject. _______
32. I am willing to take more than the required amount of mathematics. _______
33. I plan to take as much mathematics as I can during my education. _______
34. The challenge of math appeals to me. _______

35. I think studying advanced mathematics is useful. _______
36. I believe studying math helps me with problem solving in other areas. _______
37. I am comfortable expressing my own ideas on how to look for solutions to a difficult problem in math. _______
38. I am comfortable answering questions in math class. _______
39. A strong math background could help me in my professional life. _______
40. I believe I am good at solving math problems. _______

Thank you so much for your participation!

Appendix B: Interview Protocol

1. Tell me about your experiences with study skills this semester. (Prompt: What did you do? How did they help you?)

2. Tell me about the ways that you used the Cornell note-taking process.

3. Tell me a little bit about how you used your binder for your math class.

4. How do you feel about the workload that you have in your math class?

5. How do you learn math best? In what ways do you feel the study skills you learned this quarter support the way that you learn? What could have been done differently to give you better support?

6. How do you think the study skills you leaned helped or harmed your self-confidence about mathematics?

7. How do you think the study skills you learned helped or harmed how you value math?

8. How do you think the study skills you learned helped or harmed the enjoyment you get from math?

9. How do you think the study skills you learned helped or harmed the motivation you have to learn math?

10. If you were telling a friend about your math class, what would you say helped you the most in the class? The least?

*Demographics of students will also be recorded, for instance, age, race, grade and sex.

Appendix C: Sample of Transcript From Interview Session

5/2/13
In the Classroom: School A
Transcript 1

[Students from the Treatment group randomly selected and given an opportunity to participate. Six (n = 6) students agreed to participate. In the first session there were two African American males, one in 9th grade and one in the 10th grade, one African American female, 9th grade.]

[Two group sessions were held because of the schedule of the teacher and students. Each focus group had three students.]

Testing, Testing…

Researcher: I would like each of you just to tell me a little bit about ahmm, study skills this semester. Like what did you do that you may not have done in past semesters that would have counted as study skills. Tell me about your experiences with study skills this semester…something you think you have improved upon. Let's start with you…

Student 1: If I didn't understand in class I would call friends to ask them how to stuff to get a better understanding this semester.

Researcher: So this semester, what I hear you saying is you kind of had study buddies, like somebody you can call were able to ask what is this, and it took you to another level because you were able to ask questions.

Student 1: Yes.

Researcher: Anything inside of the class…anything that you were taught, anything that you were taught differently…Something that you were taught in the class that served as a study skill. That could be collaboration/collaborative groups like you described, that could be note taking, it is keeping you binders organized…All of that stuff that goes into it, what you learned about study skills, and helped you out…anything different?

Student 2: The note taking is different.

Researcher: Thank you. Tell me a little bit about what you thought helped you out. Just your experience with it—it could be a bad experience or a good experience with study skills that happened.

Student 3: I don't remember anything except as far as write the problems down and practice at home. I don't really study.

Researcher: Okay you write them down and you practice. Anything.

Student 3: I don't really study, just memorize.

Researcher: Ok. Just take notes; one of the study skills is taking notes, but you basically were just memorizing you said. That's great if you have a photographic memory…hmm…So let's…For the most part I hear you about note taking, let's talk about that for a minute….With the Cornell Note Taking that you did in class, tell me how you felt about that. Did you, was it easy for you to grasp, was it hard, did you use it…Did you use it outside of the class? How did you use it?

Student 3: It helped me decipher notes and make it easier to understand.

Researcher: Tell me a little about that. How is it easier for you to understand?

Student 3: How I usually write notes I write down on a piece of paper and I don't know which way it goes, to separate the information.

Researcher: Ok, great. What makes that separation work for you? What do you see…Is it the set up of notes or what makes it easier for you?

Student 3: How the notes are set up.

Researcher: Thank you. Did you use the notes again to study like when you got home, did you get them?

Student 3: It was a one-time thing for me.

Researcher: Ok. Once you started and learned to use the Cornel Note Taking, you didn't use or continue to use them again. Why or why not? Clarify that for me. I mean, you still took notes but you didn't go back to use them. Makes sense if you know that you were able to memorize that. I can see why you may not have seen it beneficial for you to go back at that particular time and use them.

Researcher: What about you? [Points to Student 1] Cornell Note Taking. Was it different? Was it helpful? Was it useful?

Student 1: Took notes here and there.

Researcher: Here and there. Did you find it beneficial when you did take notes? Did you find it helpful for you to take the notes? What prevented you from taking notes consistently like all the time?

Student 1: I write everything down.

Researcher: That's a good point because if you are already familiar with your notes it's okay. It's okay for that to be a study skill because that is one of the things Cornel Note Taking will help you with, identifying information you need to capture. You will have something down then you know you can look at it. What about switching gears and looking at some other organization pieces. Was there anything, did you use a binder/folder…keep information, like your math, anything you use to keep all of your information in? So notes, homework, was there anything that you used?

Appendix D: Parent Consent Form

Mathematics Attitude Study: Parental Consent Form

Dear Parent/Guardian,

Your child is being asked to participate in a research study conducted by Alberta Banks, doctoral student at Walden University. Because your child is a student enrolled in a semester long algebra course for credit recovery s/he will be a prime candidate for the study. Alberta Banks is a former middle and high school mathematics teacher who currently supports your child's high school as an AVID Program Manager. AVID is a researched based college readiness system that has assisted districts in preparing students for college for the past 30 years.

The purpose of this research is to understand the outcomes of study skills instruction on your child's attitude toward mathematics. We want to examine the ways in which the use of certain study skills strategies may affect students' feelings about mathematics.

If you decide to allow your child to participate, s/he will be asked to participate in a 30-45 minute interview session with Mrs. Banks and a couple of their classmates. The interviews will be audio taped, so your child's responses will be recorded. The sessions will take place during homeroom period so that the students will not miss any class time. There will be no compensation for participation in the study.

The benefit to being a part of this research is that your child gets the chance to express his/her feelings about the study of mathematics. It may also help other children because educators may gain insight into how students learn math. The only risk to being involved in this research is that your child may feel shy being interviewed or being audio taped. Your child may request to discontinue the interview at any time and the request will be honored with no penalty.

The things that we learn from this study will be written up in a report and shared with you, your child, and educators in the school district. Any information your child provides will be kept confidential. The researcher will not use your child's information for any purposes outside of this research project. Also, the researcher will not include your child's name or anything else that could identify your child in any reports of the study.

You may refuse to allow your child to participate and still receive any benefits you would receive if you were not in the study. You may change your mind about being in the study and quit after the study has started.

You may ask any questions you have now. Or if you have questions later, you may contact the researcher via phone 404-368-8130 or email alberta.banks@waldenu.edu. If you want to talk privately about your child's rights as a participant, you can call Dr. Leilani Endicott. She is the Walden University representative who can discuss this with you. Her phone number is 1-800-925-3368, extension 1210. Walden University's approval number for this study is **10-15-12-0035314** and it expires on **08/15/2013**.

The researcher will give you a copy of this form to keep.

Statement of Consent:

I have read the above information and I feel I understand the study well enough to make a decision about my child's involvement. By signing below, I am agreeing to the terms described above.

Printed Name of Child	______________________________
Printed Name of Parent or Guardian	______________________________
Date of consent	______________________________
Parent's Written or Electronic* Signature	______________________________
Researcher's Written or Electronic* Signature	______________________________

Electronic signatures are regulated by the Uniform Electronic Transactions Act. Legally, an "electronic signature" can be the person's typed name, their email address, or any other identifying marker. An electronic signature is just as valid as a written signature as long as both parties have agreed to conduct the transaction electronically

Appendix E: Child Assent Form

ASSENT FORM FOR INTERVIEWS

Hello, my name is Alberta Banks and I am doing a research project to learn about how algebra students at your school feel about the use of different study skills in your math class. I am inviting you to be a part of a study as an interviewee to discuss how you specifically feel about your use of study skills strategies in math. I am going to read this form to you. I want you to learn more about the interview process before you decide if you want to be interviewed.

WHO I AM:
I am a student at Walden University. I am working on my doctoral degree. I am a former math teacher who now works with a company (AVID) that helps schools prepare students to go to college.

ABOUT THE PROJECT:
If you agree to be interviewed, you will be asked to:

- Meet with me and a couple of classmates for 30-45 minutes in an empty classroom or conference room
- Answer questions about your use of study skills strategies in your math class
- Have your responses be audio taped

Here are some sample questions:

- How do you feel about the workload that you have in your math class?
- If you were telling a friend about your math class, what would you say helped you the most in the class? The least?

IT'S YOUR CHOICE:
You don't have to be interviewed if you don't want to. If you decide now that you want to be interviewed, you can still change your mind later. If you want to stop, you can.

Being interviewed will be similar to being in a study group lead by a teacher, tutor, or guidance counselor. You will be asked a few questions and your responses will be recorded. The only risk to being involved in being interviewed or being audio taped is that you may feel a little shy. Keep in mind that you can stop the interview at any time. Hopefully, information from the interviews may help others by discovering ways to influence students' attitudes toward algebra which may impact the number of students who pursue math related careers.

PRIVACY:
Everything you tell me during this project will be kept private. That means that only those in the room will know your name or what answers you gave. The only time I have to tell anyone else is if I learn about something that could hurt you or someone else.

ASKING QUESTIONS:
You can ask me any questions you want now. If you think of a question later, you or your parents can reach me at alberta.banks@waldenu.edu . If you or your parents would like to ask my university a question, you can call: USA number 001-612-312-1210 or email: irb@waldenu.edu .I will give you a copy of this form.

Please sign your name below if you want to participate in the interview session.

Name of Child ____

Child Signature ____

Date ____

Appendix F: Letter of Cooperation

Rodney Bullard, Director of Curriculum
January 7, 2013

Dear Alberta Banks,

Based on my review of your research proposal, I give permission for you to conduct the study entitled *The Effects of Embedded Study Skills Instruction on High School Students' Attitudes toward Mathematics* my school district. As part of this study, I agree to release the de-identified survey data to you from the students completing the Attitudes toward Mathematics Inventory at the high school. For the past four years, the school has implemented the AVID (Advancement via Individual Determination) curriculum. In the first year of implementation of the AVID methodologies, several teachers were trained on the use of instructional strategies which include such best practices as Cornell note-taking, peer tutoring, critical writing and reading, Socratic Seminars, organizational techniques such as binders and others. It is my understanding that you will merely analyze the de-identified data to determine if there are any significant differences in the attitude of students whose teachers use embedded study skills instruction in their mathematics classes.

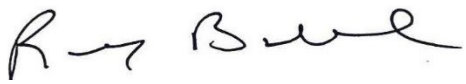
I also give authorization for you to interview 9th grade mathematics students at the site whose parents have given informed consent. You will be allowed to randomly select ten students from the pool of 9th grade mathematics students who completed the attitude survey to be interviewed by you during their homeroom period. Individuals' participation will be voluntary and at their own discretion.

We understand that our organization's responsibilities include: providing you de-identified survey data, providing a conference room to conduct ten 10-15 minute interviews, and access to school personnel (i.e., guidance counselor) should a student need attention during data collection. We reserve the right to withdraw from the study at any time if our circumstances change.

I confirm that I am authorized to approve research in this setting as the district's Director of Curriculum and Instruction and that you have sought, and received, permission from the school principal after a full disclosure of your research methodologies.

I understand that the data collected will remain entirely confidential and may not be provided to anyone outside of the research team without permission from the Walden University IRB.

Sincerely,



Rodney Bullard, Director of Curriculum

Curriculum Vitae

ALBERTA D. BANKS

Education

Doctorate of Education, **Teacher Leadership**, Expected February 2015, Walden University, Minneapolis, MN
Doctoral Study: *Effects of Embedded Study-Skills Instruction on High School Students' Attitudes Toward Mathematics*

Master of Education, **Mathematics Education**, May 2002, Kennesaw State University, Kennesaw, GA

Bachelor of Science, **Mathematics Education (Grades 6-8)**, June 1995, Mercer University, Macon, GA
Certification: Middle Grades Mathematics and Science (T4)

Research Interests

Secondary Mathematics Instruction and Assessment
STEM Education
Metacognitive Skillfulness
Students' Attitudes toward Mathematics
Teacher Leadership

Professional Experience

Program Manager, AVID Center, Eastern Division, Atlanta, Georgia
2008 – present

- Coach school sites to quality implementation of the AVID College Readiness System, provide professional development to teachers, administrators, and district personnel, and coordinate regional and national professional development events

Mathematics Department Chairperson, McEachern High School, Powder Springs, Georgia
2005 – 2008

- Provided support for regular and special educators. Facilitated local training for Georgia Performance Standards and the new integrated math curriculum adopted by the state.

Mathematics Instructor, McEachern High School, Powder Springs, Georgia
2002 – 2008

- Analyzed data for data driven instruction and developed remediation strategies which included embedding the AVID strategies in order to improve student performance academically.

AVID Instructor, McEachern High School, Powder Springs, Georgia
2004-2008

- Provided students with instruction to prepare them for college and careers by utilizing the AVID curriculum

Mathematics Instructor / Coordinator, Cooper Middle School, Austell, Georgia
2001- 2002

- Provided leadership to peers in math education.

Conference Participation

2013 College Board Southern Regional Forum-Presenter
Presentation- The AVID College Readiness System
2011 College Board Southern Regional Forum-Presenter
Presentation- AVID College Readiness for All
2010 National Youth At Risk Conference- Presenter
Presentation-AVID Closing the Achievement Gap by Preparing All Students for College Readiness
2008-2013 AVID National Conference - Participant